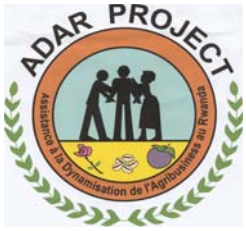

ASSISTANCE A LA DYNAMISATION DE L'AGRIBUSINESS AU RWANDA

R E P O R T

AGRIBUSINESS IN SUSTAINABLE NATURAL AFRICAN PLANT PRODUCTS(ASNAPP) NATURAL PRODUCTS ASSESSMENT

POTENTIAL FOR ECONOMIC GROWTH AND TRADE IN RWANDA

CATEGORY: MARKET ASSESSMENT

TARGETTED RECIPIENTS: USAID COUNTRY PARTNERS, RWANDA

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Sous :

Le Projet ADAR
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1. SUMMARY

There is evidently much potential for increasing export of traditional and non traditional, organic and conventionally grown, natural product crops and of value added products made from these crops.

A great deal of detailed work has already been done on the potential for agricultural crops, much of it recent and sponsored by USAID/Chemonics/ADAR and ASNAPP, among others. This work has assisted *inter alia* several Rwandan producers into perishables export, and 3 producer groups into Organic farming.

The major challenge is always to find and assist motivated entrepreneurs to bring viable projects to fruition.

The main Rwandan export crops are tea and coffee. Progress has been made in resuscitating the next largest traditional exporter- the pyrethrum industry. These crops have been extensively researched, and are outside the scope of this report.

Land pressure is high in Rwanda and production of new crops will in general compete with existing land use- in most districts all possible areas of land (and some that would seem impossible) are under cultivation. However yields are generally a fraction of potential. Land productivity is a national priority, and the use of low input cost methods (much the same as are used in Organic production) should be encouraged in general agriculture, partly because chemical fertilizers are not widely affordable. Some work on legume interplanting and rotation is being done to provide an affordable source of plant nitrates. Most Rwandan soils are acutely deficient in phosphates. Rock phosphate is available in the region and is much less expensive per unit of nutrient than chemically processed superphosphates. Lime is available locally. Agricultural extension services are currently weak.

Some elements of an agro-industrial base are present. A sugar refinery is operating (and there is a distillery capable of producing cane alcohol). Paint and cosmetics industries are operating and can provide a local market for fixed and essential oils, and there is some dairy processing capacity. ISAR has a Plant Tissue Culture laboratory. No canneries, oil mills or dehydration facilities are operating. Plastic packaging is being produced to acceptable standards but there is no can or glass manufacturer.

Air freight costs from Rwanda are reasonably competitive. Surface transport costs are high The cost of shipping in to Rwanda gives import substitution some competitive advantage.

Rwanda's strong currency is a challenge, particularly to the viability of traditional crops like coffee where prices are weak.

Natural product groups which should be viable from both export market and production standpoints for Rwanda, and for which recommendations are made in this report include:

Essential Oils. An industry existed previously, and some production capacity is available and could be brought into production at low cost. Eucalyptus is the immediate opportunity, Geranium has good potential, as have organically certified lemongrass and citronella, and a number of other oils discussed in the report.

Herbs and Spices: Paprika may present an opportunity, particularly if it can be processed into an oleoresin product at SOPYRWA. Birds Eye chillies grow well and fit with the country's labour availability. Vanilla, pepper (*Piper nigrum* as well as capsicum pepper), ginger and turmeric etc., and herb tea crops like chamomile and lemon verbena are discussed as possible new crops.

Fresh Produce: Prospects for these products have been reviewed in recent ADAR reports, and recommendations have been made in these reports for fine beans, mange tout, tropical fruits i.e. passion fruit, apple bananas, physalis (Cape gooseberry), and capsicums for both conventional and organic produce.

Medicinal plants. Quinine (cinchona) bark has been exported recently according to official statistics. *Prunus africanus* exists in diminishing quantity in the wild and is listed as endangered. With the pressure on forest land, and the deforestation that has occurred, export of wild collected material is probably not sustainable. A policy of cultivation of medicinal forest trees is being implemented to make sustainable exports possible eventually.

Fixed (Pressed) Oils: Evening primrose and avocado -preferably organic certified- are possibilities for export. Sunflower (for local industrial use e.g. in paint) and other lower value expressed oil products would have a viable local/regional market and would provide a nucleus for value adding and infrastructure development.

Value Added Produce. Processed passion fruit, tomato and other produce are dealt with in detail in the **CIRAD** report summarised in Annex I- recommendations are dried fruits like physalis and banana for export, and for a tomato concentrate plant to be reopened to supply the local/regional market.

A niche export market may be found for ethnic value added branded products. Herbs and spices could be sold locally and into Kenya and Uganda packed in sachets for retail, as well as in bulk.

The local/regional market would be small, but worth encouraging as a nursery to develop expertise, which in turn might lead to an extended range of value added exports such as prepared condiments and sauces.

Organic Production. Rwanda is in some ways well placed to produce to certified organic standards as currently most crops are grown without inputs. However, Organic standards require sustainability, and soil fertility improvement is necessary. Certification will generally involve many small producers, with the attendant problems of ensuring compliance among a larger number of principals. Considerable work has been done in Rwanda to encourage certification. The premium available on most organic crops can help cover transport costs, and input costs are lower. Essential oil crops are good organic prospects as spent material can be recycled, and little plant nutrient is removed in the oils. The growth in demand for organic products varies, but estimates generally put the trend at between 10-20% p.a., from a low base.

2. OBJECTIVE OF THE REPORT

The objective is to assess currently available information sources, and to analyse production capabilities and potential for development of Rwandan natural products domestically and for export.

Recommendations are mainly for ASNAPP's selected Natural Product groups- to include **Organic Crops, Spices, Herb Tea Crops, Essential Oils, Natural Medicines**, and **Non-Wood Forest Products**- and are based on the findings of the initial **ASNAPP Product Assessment Report** on Rwandan production capacity.

3. INFORMATION AVAILABILITY

The consultants were greatly helped by the assistance given during interviews and visits to private businesses, research institutions, government agencies, NGO's and many others. The staff at ADAR and other sponsoring agencies were most helpful in providing assistance for desk research.

As the report covers a large number of different crops and processes, the discussion has had to be condensed. The bibliography refers to studies which give much more detail on individual crops.

4. BACKGROUND

4.1. Sponsorship of Report

This study was requested as a follow-up to the preliminary country assessment conducted by ASNAPP (Agribusiness in Sustainable Natural African Plant Products) in February 2002. As a result of the recommendations of the exploratory report ASNAPP was further requested to help carry out the prior product assessment and this market report in order to highlight the potential and prospects for a Natural Plant Products sector to contribute to the diversification of the agribusiness environment in Rwanda.

ASNAPP is a USAID co-funded program established in 1999 to help develop and implement sustainable African businesses in the natural products sector. Its mandate is largely to help develop economic activities based on natural products in order to provide income, employment and economic development through environmentally and socially conscious sustainable production of high-quality natural products for local, regional and international markets. ASNAPP's vision of the overall program is to improve the quality of life in Sub-Saharan Africa with a special focus on rural communities and small to medium scale farmers through development of entrepreneurship in natural plant products. This activity will help select those crops or natural products with the most potential for contributing to increased and sustainable incomes among small-scale farmers in Rwanda. The ASNAPP long-term goal is to move producers gradually up the value chain, so that rural communities will be able to capture benefits from value-adding activities such as processing, packaging, etc. The potential for value addition is therefore a major focus of the survey.

4.2. Review of Existing Publications

Much relevant and useful research has already been done which covers aspects of production, transport and marketing of Rwandan natural products, and the reader is referred to the report bibliography listed at Annex I. A number of these reports have been sponsored recently by ADAR. The findings of these reports are summarised. One aim of the report is to provide a summary of recent information- but much excellent work was done in the 70's and before, when many of the agricultural prospects currently being reviewed were examined in detail- much work survives in the IRST library at Butare, for example.

The summaries we have made of the bibliography cannot do justice to the detail and analysis presented by the professionals who produced the publications- these summaries are only intended to give those interested an indication of the contents. Market reports are generally available at the ADAR/ABC library in Kigali.

5. ASSESSMENT OF CURRENT RWANDA LOCAL MARKET FOR HIGH VALUE NATURAL PRODUCTS

5.1. Market Segmentation

Upper income outlets and consumers tend to favour imported retail packed products, and to avoid traditional local foods like cooking bananas and sweet potatoes- even though the quality of these is among the best in the world. The Rwandan market could be divided into three categories: i) A minority of upper income people who can afford most consumables. This class is likely to buy more imported goods from Europe, South Africa than goods locally produced. i) Intermediate class. Between the upper and middle classes, there is a an emerging class of consumer- businesspeople who trade with neighbouring countries and consume imported goods (e.g. from Uganda, Kenya and Dubai). iii) Middle income people engaged in the struggle to make month ends meet. Most civil servants are in this category and they have to support relatives in rural areas. They can only afford to consume cheaper goods. iv) Low income consumers- most of the Rwandan market. They live mostly in the countryside – mainly from subsistence farming- with limited cash income from selling farm products. This segment has a very low buying capacity.

5.2. ASNAPP Selected Natural Products Currently Produced/Used in Rwanda

Very little falling within the ASNAPP natural products groups specified in the consultancy terms of reference is currently produced in Rwanda. The only ones in significant general use (rather than sold in upmarket food stores or used in European style restaurants) are chillies- including some Birds Eye- and Traditional Medicines. However, most Natural Products used in Rwanda are supplied by imports- e.g. spices (bulk and retail packed), herb teas, citronella oil. A brief general account of demand patterns is given for background.

5.3. Fresh Produce Production

Volumes and seasonal patterns of local production have been analysed in detail in previous reports, and a summary of their contents is set out in the Bibliography (Annex I). Many crops can be grown year round in the wetlands. Seasonality is influenced by rainfall patterns- the rains generally extend from mid September to mid December, and from mid March to mid May. Passion fruit production for example peaks in May, and is at a minimum in November. Bananas are by far the most important individual crop- for banana beer production, cooking bananas and fruit type, and are available all year round- with a tendency for oversupply to occur following the two main rainy seasons. The Ministry of Agriculture produces a monthly market price guide for most locally grown commodities with price trend graphs- www.cgiar.org/foodnet/fdnet/market/rwanda1.htm

5.4. Value Added Locally Grown Natural Products

Rwandan tea and coffee (not instant) is available in bulk and retail packaged in shops- including tea bags from Highland Teas- its tea bag machine would probably work adequately well in packing herb teas, e.g. chamomile. If this crop were locally grown there would be a small Rwandan market. Some good quality jams are produced. Passion fruit juice concentrates are made by several firms, and the small market is oversupplied. Packaged spices, pasta sauce and other tomato based relishes are currently imported but could be added to the locally produced ranges of existing processors. While volumes would be low, entry costs are not high, the marginal costs of adding to a range are low, and gross margins should be good- with 100ml size plastic bottles of spices selling retail at around US$ 1.40 per unit for example. Food shop markups range from 20-40%. If locally packed spice sachets are priced at say 60% of the equivalent imported jars, they would be sold to the shops at 60c US. This is higher than prices to spice packers in most markets, and should allow a viable return..

Pyrethrum products such as mosquito coils, sprays and repellents are currently all imported- SOPYRWA make sprays for agricultural use, but these do not seem to have entered the urban markets.

5.5. Bulk Dry Culinary Natural Products

There is a small local market for herbs and spices- mostly chillies. Pepper (*Piper nigrum* or black/white pepper) is used mainly in upper income homes and restaurants. Cooking oils are all imported at present. Most herbs and spices normally used in cooking have been grown in Rwanda in the past.

5.6. Essential Oils

There would be potential customers for Citronella oil in the local cosmetics industry and interviews suggest there would be a market for 2-3 tons p.a.,. if local producers can compete with imports on price. Citronella is widely used (generally at around 1%) as a perfume in soap and for insect repellent candles (produced by Sulfo) and is one of the cheapest natural fragrances. Geranium would probably be too expensive for use in local soaps and cosmetics. Eucalyptus is used in cleaners, and the market for these is limited- no local market for this oil was found.

5.7. Medicinal Products

Locally produced traditional medicinal products are said to be used by 80% of the population. A small number of pharmacies stock imported medicines and could be induced to try stocking locally produced formulations if these were registered with the Ministry of Health. A detailed account of the IRST work on the commercialisation of medicinal plants is at Annex I.

6. CURRENT PARTICIPANTS IN RWANDA'S NATURAL PRODUCTS MARKET

6.1. Growers and Gatherers

The agricultural production base is the smallholder farmer for most crops, but a trend is emerging of larger scale corporate farming. Assistance is provided to the growers by a variety of NGO's (contact details are in the ADAR directory) -e.g. World Vision, CARITAS, Catholic Relief Service, GTZ, DED, SNV, World Relief, etc., and numerous local NGO, most of them members of CCOAIB, an umbrella organization for organizations working at grassroots level, and Church organisations -e.g. Gahini diocese has land and outgrowers keen to find cash crops, and is interested in Organic farming and promoting sustainable low input farming methods. Since the small number of staple crops produced by small scale farmers in Rwanda are in periodic glut, farmers are looking for opportunities to grow cash crops on contract

6.2. Processors

Contact details are given in Annex IV.

Insecticide Extraction:

SOPYRWA has a pyrethrum plant capable of producing crude extract from an estimated 2500 tons of flowers. The plant tends to be unused between July and September, and might be usable for distillation (see below) or solvent extraction of other produce like paprika. There is an unused wood fired boiler which could be refurbished, and some old condensers which might be salvageable for use in an essential oil distillation plant.

Cosmetics:

- **Sulfo.** Soaps and Candles.
- **SAKIRWA.** Producer of soaps, candles and cosmetics**.**

Food Products (Agro Industry):

Some of the operations listed below and possible new agro-industrial projects are reviewed in detail in a confidential **CIRAD** study (See Annex I).

General. Locally made food/beverage products include soft drinks, cheese, biscuits, retail packed tea and coffee and bottled water.

Shema Fruits s.a.r.l. Butare. Visited for this report. Jams and fruit concentrates. Have PH and Brix meters. Capability to produce sauces, condiments etc.

Entreprise SINA. Fruit concentrate and juice. Not visited..

PRONATURE. Fruit concentrate and juice. Not visited.

Inyange Dairy. Yogurt.

SORWATOM. Not operating –the plant is out of commission but used to produce 500t p.a. of tomato concentrates, for which there is a strong demand currently met by imports. Rehabilitation cost estimated (by CIRAD) at US$430,000 including a new boiler and a foil pack plant for the product. This plant was outside our terms of reference and was not visited. However, a cheaper quotation for refurbishment could probably be obtained from Southern Africa-several tomato plants have recently been built or refurbished there recently- and the existing boiler refurbished on site.

Paint Manufacturers

Ameki Colour uses sizeable amounts of vegetable oil e.g. sunflower for use in making paint resins and are interested in an oil expression plant, which could also serve as a pilot plant for other expressed oils.. Other paint manufacturers might also be potential customers for locally pressed oils.

6.3. Natural Medicinal Products

The local trade is informal and difficult to quantify, but well established, and is covered in detail in the relevant section of the bibliography review (See Annex I). Unlike some central and west African markets (e.g. Ghana, Nigeria and Cote d'Ivoire as reviewed in the ASNAPP/USAID/Rutgers University study (See Annex I)), Rwanda has no large and stable areas of indigenous forest from which significant quantities of medicinal plants can be sustainably wild harvested. The only viable option is to integrate medicinal plants into farming systems, as discussed under the section on medicinal plants.

Much information on medicinal plants is available from IRST, individual traditional healers, associations of traditional healers and the Centre for Traditional Medicine. There are some initiatives in rural areas to register all traditional healers (e.g. the Health District of Nemba with already more than 600 traditional healers, half of which are organized into associations). Most useful plants are harvested in the wild and some traditional healers reported the impracticality of walking for long distances to harvest particular plants which are not found in their vicinity. In a country where about 80 % rely on traditional medicine, the need for collaboration between conventional and traditional medicines is evident. Some initiatives in that area are already operational (e.g. Centre de la Pharmacopée in Butare and the Centre for Traditional Medicine located in the premises of IRST). The case of ASAF (Association pour l'Amélioration de la Santé Familiale) in Rubengera (Kibuye) where qualified nurses are running a centre for traditional medicine is another.

6.4. Importers, Wholesalers and Retailers

There are no modern shopping malls or large supermarkets. There are few wholesalers in the small local market- most traders will buy from manufacturers or importers, and if quantities are small, from larger retailers. Informal street markets are illegal and the law is largely enforced.

Imports of ***Prepared Foods*** are listed officially at Rfr 1.7bn, and ***Vegetable and Animal Oils*** at Rfr 3.2bn.

6.5. Local/Regional Networks (Local NGO's, Associations And Cooperatives)

A list is included in Annex I and in the ADAR Directory.

6.6. Sponsors/Donors

Among these are:
USAID and Partner Agencies
GTZ Germany
DFID UK
World Bank
UN Agencies

The and other donor addresses are as listed in the ADAR contacts directory. (Annex I).

7. CURRENT PROCESSES AND PRACTICES

7.1. Crop Production Practices

Almost all land preparation and crop maintenance is done by manual labour- there are very few tractors or draught animals in use.

Very little fertiliser is used in smallholder farming. A 17:17:17 NPK mix is the standard application where fertilisers are used- mainly for tea and coffee. Prices from Compagnie Agricole BP 4999 Kigali: NPK 17-17-17, Urea, DAP- all 0.54 US$ per kg.

Rock phosphate appears not to be used. Sources of supply exist close to Rwanda in Uganda and Burundi, and also in Tanzania. An analysis of the phosphate (not the more usual $P_2 O_5$) content is: Minjingu 12.9%, Busumbu soft 12.9%, Bisungu hard 14.1%, compared with triple super phosphate (TSP) with 19.9%. phosphate (Univ National du Rwanda Evaluation des divers Phosphates sure L'Amelioration de la Fertilité´des Sols Acides et leur Effect Residuels dans le Plateau Central du Rwanda. Nyezimana V.).

The fact that use of chemical fertilisers and pesticides is small apart from the major export crops- (tea and coffee) may make organic certification easier to obtain. Against this the country's production is currently mainly from smallholders, and certification agencies will need to be convinced that the numerous small producers will understand and adhere to the EU regulations- and a large number of visits to individuals (though only a percentage are normally selected for direct inspection) will be needed. This increases the cost and complexity of certification.

Irrigation is mainly hand watering from buckets on wetlands- few powered sprinkler or drip irrigation schemes are in operation.

7.2. Drying and Storage

Crops are mainly sun dried. Some like pyrethrum are dried by wood fired driers or simple solar driers. The short duration of the dry seasons makes unassisted sun drying a problem.

Larger storage facilities are used by food relief agencies. OPROVIA is a government agency which used to store and market grain crops but is in the process of being privatised. Very little chemical fumigation is done.

No low cost methods of storage were seen- e.g. use of airtight bins so CO_2 levels rise and kill storage pests, or insecticidal leaf dust use e.g. pyrethrum, tephrosia or tagetes.

7.3. Quality Control

The **Office Rwandais de Normalisation** produces standards. PO Box 6185, Kigali.

SGS CHECKS IMPORTS AND EXPORTS FOR COMPLIANCE WITH CUSTOMER AND LEGAL SPECIFICATIONS.

The University and IRST have facilities for analysis of essential oils and microbiological contamination of foodstuffs- this should be checked with samples of oils and foods- dried fruit and herbs/spices, etc., and results could be compared those recorded on check samples sent to customers and external laboratories to build credibility for Rwandan analytical capability.

7.4. Transportation

Adequate air freight capacity appears to be available and prices workable for high value products like essential oils, but not for dried herbs. Good liaison is needed, and if airfreight business is available and estimated and actual volumes are reasonably consistent, air operators will service the demand. The ADAR **Visit report on Airfreight Options for Rwanda** is current and detailed- prices are around US$1.75/kg to the EU. This compares well to Kenyan airfreight costs- $1.60- $1.80 per kg in spite of higher volumes- possibly since fuel taxes are higher in Kenya. Airfreight on direct flights to South Africa costs around US$1. Surface transport is relatively expensive- quotations have been received for $3,225 for a 20ft container to Mombasa, and $1300-$1600 from Mombasa to Amsterdam- total to the EU $4500 plus, or 45c per kg. Regular users should be able to negotiate better rates, as do some current exporters.

Internally, transport of goods for processing or direct sale ranges from 30 tonne trucks to 10 kg loads carried by pedestrians. Rwanda is connected to its four neighbours by tar roads in reasonable to poor condition. Most of the import/export cargo travels via Uganda/Kenya or Tanzania/Kenya. An experienced lorry driver takes about a week to reach Mombasa port (Kenya). Transport within Rwanda is relatively cheap- with each province linked to the capital by tar roads.

7.5. Packaging

Some acceptable quality packaging is made locally, such as plastic bottles for mineral water- e.g. by Sulfo. There is no glass or tinplate manufacturer, or cannery.
High quality labels are imported. Most types of packaging material is available from Uganda and Kenya, and glass containers are made in Burundi.

7.6. Perishables Marketing

Covered produce markets exist in the cities. Generally produce is sold on the spot market rather than against contracts, and there is very little cold storage capacity- this leads to frequent gluts and shortages. Market traders contract some production for crops that are grown on a larger scale e.g. pineapples, but farmers are always looking for contracted cash crops to avoid having to dump surpluses at uneconomic prices in the frequent periods of oversupply.

7.7. Agro Industrial Capacity.

7.7.1. Sugar Cane

The existing sugar factory supplies part of the local market with an acceptable grade of raw sugar. Some processors buy imported white sugar as their customers prefer a lighter coloured jam or juice. Much locally grown sugar cane could be certified organic- most of it is grown without fertiliser on runoff silt, and it should be reasonably simple to obtain organic certification for the factory and might be worthwhile if this was needed to support local organic jam production. It is unlikely that organic bulk sugar from Rwanda would have a competitive advantage given transport costs and the small scale of the industry.

7.7.2. Steam Distillation Plant

Sitting of essential oil distillation plants needs to be at a water supply, close to a sustainable plantation source of fuel if wood is to be used (as in Rwanda), and within reasonable distance of where the material to be distilled is located- given that 1% or less of the material transported will be distilled into essential oil.

Photograph 1: Steam Distillation Plant- IRST

Photograph 2: Lemongrass Stand at IRST

IRST Pharmacy Station has a distillation unit with 3 small stills, ranging from about 100 to 600 litres capacity, each with condenser. The plant is not in regular use, but appears to be in working order. The wood fired boiler had no capacity information plaque visible, but this is likely to be in excess of 1000kg per hour. This is much more than the power needed for the stills as the boiler was designed to power an alcohol plant- used to provide the local requirement of a few thousand litres of medicinal alcohol for the health sector.

The boiler and the steam pipes to the stills needed to have the insulating lagging repaired and installed respectively. Capacity of the 3 stills, which could be operated together and do 6 charges per 24 hour period, would probably aggregate to about 2 tons of leaf material per day- about 20 kg of Eucalyptus oil at 1%, for example. The capacity of the stills is small for a commercial operation, but the boiler- an expensive part of the facility- could serve at least 10x the existing still capacity. The stills do not appear to be necessary for the pharmaceutical research being undertaken, and any trial distillations required to be done for research on lesser known oils could easily be combined with a commercial operation to distill such well-researched oils as eucalypt and lemongrass.

The IRST station has about 30 ha of partly terraced land near the stills and more nearby, including a reported 15ha of geranium. Geranium, vetiver and lemongrass are the essential oil plants seen, in small quantities in poorish stands and in soil which exhibited some nutrient deficiencies.

Lemongrass (*Cymbopogon citratus)* is called "citronelle" in French- a source of confusion as citronella grass *C. nardus*– is often called citronelle as well. *Eucalyptus maideni* (a species similar to *E. globulus*) seems to be in good supply in the area.

ISAR has a wood fired direct heat still of around 1000 litres charge capacity which is understood last to have been used in 1981. However it is basically sound, and needs only a small amount of welding, some repairs to brickwork for the furnace, a hand pump to bring water a short distance, and a block and tackle with sheer legs to remove the gooseneck top and the spent still charge.

ISAR seemed receptive to the idea of reviving the distillation operation. In the past a consortium of local farmers ran the plant and distilled Eucalyptus, Geranium, Lemongrass and Vetiver. A call to the Mayor of Kiruhura about the marshland of Rusuri-Rwamuginga and the associations of rice growers indicated that he was in the favour of convincing farmers to grow any other crop which might bring in more money than the rice currently grown in the adjoining wetland. Mr. Viateur Ngiruwonsage of CRS Butare who participated in making the infrastructure of drainage and irrigation told us that the whole marshland has about 150 Ha of which 20 belong to ISAR. He did also agree that any other crop which might present comparative advantages to rice, would be welcome. Farmers have settled for rice after trying rice, maize and soya beans. He suggested that if it were decided to implement a new project, it would be best to contact the Ministry of Agriculture and see what their plans are for the marshland.

7.7.3. Solvent Extraction Plants

SOPYRWA has the sole solvent extraction plant in Rwanda. The solvent extraction equipment at the pyrethrum plant would also be able to be used for extraction of paprika oleoresin. The plant can not reduce residues below about 1.5% solvent in the pyrethrum extract, which is not acceptable in a food product. The solvent residue in any paprika oleoresin could be reduced elsewhere (a Zimbabwe processor has indicated it would be prepared to so) to less than the required maximum- generally 25 ppm (parts per million), and it would be necessary to ensure that there is no trace of pyrethrins in the paprika extract.

The plant could also be used for distillation of essential oils with minimal modifications. The plant has a 2000kg per hour boiler- sufficient steam to distill simultaneously 6 vats each of which might hold 500kg of leaves for distillation- less than for pyrethrum which is milled rather than say eucalyptus where whole leaf and small stems are used. Availability of suitable eucalyptus plantations in the area needs to be confirmed.

If the material is there, a full time shift system of 5 charges could be distilled from each vat per day, or 12,500kg per day- and at 1% recovery rate for eucalyptus the oil yield would be a significant 125 kg per day.

Steam distillation could be done using the plant as follows:

The vats would be cleaned of all pyrethrum residue. The hexane inlet valves would be closed and steam introduced into the base of the product vats. A thorough (2 hour minimum) clean out with steam should be done to remove all traces of the solvent used (hexane) from the entire system up to and including the condenser, and after disconnecting the condenser from the hexane collection tank and connecting a pipe to an open collection drum. The condenser should be emptied of coolant water so the condenser tubes reach steam temperature. After 2 hours, replace the condenser coolant and check the distillate for hexane and pyrethrin residues- there should be none detectable. A trial charge of eucalyptus globulus leaves should be placed in the vat and distillation carried out for about 2 hours until no further oil is apparent in the distillate. A simple but practical oil/water separation method for the trials (ultimately a separation or Florentine flask should be used) is to skim the surface of the distillate collected in the open drum, place the liquid in a plastic bag with a small hole at the base closed with a peg, leave until the oil has separated from the water and then drain the water through the hole in the base of the bag until only the supernatant oil remains.

N.B. The safety aspects of using the plant for steam distillation or paprika extraction when not in use for pyrethrum- need to be checked with a pyrethrum plant engineer expert- e.g. ADAR's pyrethrum consultant on the plant. We understand that a pyrethrum plant in Tanzania was successfully used in the way suggested for steam distillation, and solvent extraction plants can generally be used successfully for a variety of crops if required.

7..7.4. Vacuum Concentration Plant

As discussed, no functioning plant is available. A tomato concentration plant owned by SOWARTOM could be resuscitated. There is interest in an aseptic juice concentration plant- which is the only proven way of producing a quality product without preservative chemicals.

7.7.5. Oil Mills/Presses

Four screw oil presses have been identified but not checked, and are reportedly functional but not operational.

7.7.6. Dehydration

Solar or eucalyptus wood fired dryers are used on pyrethrum flowers from outgrowers prior to transport to the extraction plant. The use of eucalyptus wood means that leaves are available at the collection points for transportation to the plant. The solar dryers used are cost effective simple frames with a woven matting strip tray under a plastic roof- these would work for birds eye chillies, paprika, lemongrass leaf, chamomile etc- and perhaps for dried fruit.

More efficient and slightly more elaborate solar designs are available. Intermediate Technology Group UK (**ITDG)** has been producing simple designs for agro industrial purposes for many years- www.itdg.org - from solar dryers to sugar processing equipment.

Innotech. innotech.ing@t-online.de http://home.t-online.de/innotech.ing- makes a small cabinet dryer. A double tunnel with clear plastic as an outer layer and black as an inner works well to provide warm air to a dryer- solar or as a preheater for a fuelled dryer.

IRST Butare has 2 cabinet dryers with perhaps 1. cu m capacity each, and it is understood that they can dry at temperatures around 40 deg C- suitable for trials on herbs, fruit and vegetables.

7.7.7. Agrochemical Formulation

SOPYRWA has produced a basic guide to making sprays for insects and ticks from the solvent extract it produces. Pyrethrum spray formulations are also available from the Pyrethrum Board of Kenya (copies in the ABC library) for with recommendations for ticks, cockroaches, lice, mosquitoes etc. The spray has a low mammalian toxicity, but care should be taken not to poison bees or fish, and it will kill insects including beneficial predators.

It is also a simple matter to make a spray, direct from the pyrethrum flowers by soaking overnight 1kg of preferably ground flowers in 10 litres of hot water, or paraffin, and adding 100 mls of liquid soap. The liquid is kept away from light and filtered through a coarse woven cloth, and sprayed using a hand sprayer- or even painted on the walls. Normally a synergist such as piperonyl butoxide is used to enhance effectiveness and perhaps persistence- in the past sesame oil was used for this purpose. However the spray is effective without synergist but breaks down in light quickly so should be sprayed in the late afternoon in the field. For domestic use indoors light sensitivity is not such a problem, and the spray would help in malaria prevention at low cost.

Other sprays can be made from the Fish Poison tree (the leaves of this useful legume contain rotenone, and the spray is permitted under Organic farming rules) and neem. Recipes are easy to find on the web, and one site is www.iirr-africa.org

In many countries, pyrethrum is not registered for use as an insecticide. Although it has been used for millennia, the rules generally are that insecticides must undergo field trials and be approved by the authorities. Rwanda is no exception, but it is understood that the registration process is underway. However, it is doubtful if any legislation in place would prohibit individuals from making their own sprays.

7.7.8. Raw Material Supply

The question of supply of plant material is covered in the associated ASNAPP Production Report. More work needs to be done on the quantifying the availability of medicinal plants such as Prunus and Quinine (*Cinchona*). These could be produced sustainably by good control of bark cutting to avoid ring barking, over harvesting, etc., if supported by cultivation. Work is being done by ISAR and ICRAF on cultivation of these trees.

8. CURRENT RWANDA INFRASTRUCTURE

8.1. Natural Conditions

The suitability of the country for growing the various crops is dealt with in the associated **ASNAPP Production Report.** Many non-traditional high value natural products could be sourced from Rwanda. There are limited low altitude sites with adequate rainfall, which might make the country less suitable than e.g. Uganda for growing a crop like vanilla- traditionally grown up to 600m. The widespread availability of riverine wetlands similar in application to Asian paddy field systems makes low cost production of irrigated crops possible.

8.2. Energy Resources

There are no currently exploited coal resources. Electricity costs are reasonably competitive regionally at 42 Frws/Kwh or U$0.09 /Kwh. Liquid fuel costs are comparable with neighbouring countries although Kenya reportedly has higher tax rates on aviation fuel.

While eucalypts and other planted timber is available in many areas, fuel is often a scarce resource. A great effort has gone into forestation, mainly with eucalypt species, and firewood is widely available, but demand for arable land makes deforestation of indigenous woodlands a severe problem. Some work is being done on developing natural gas supplies from Lake Kivu.

8.3. Education and Skills

Trade skills are in short supply. The main training centres are the Kigali Institute of Science and Technology, National University of Rwanda, Université Libre de Kigali and a small number of secondary schools which offer artisanal training.

8.4. Institutional Support

8.4.1. Agricultural Extension

DRSA (Regional Direction for Agricultural Services) provides extension and planning services, and works in conjunction with NGO's and donors. Extension services have not recovered from the events of the 1990's and are not as well funded as before. Given that Rwanda, with its economy dependent on smallholder farmers, has too many people to farm the existing land area under the current low input low yield model, effective extension is vital for Rwanda's future. A thorough analysis of the recent history and current developments in the area of agricultural extension is at Annex V.

8.4.2. Research & Support Services

- **ISAR** (Institut des Sciences Agronomiques du Rwanda) has 10 research stations and focuses on staple crops but is researching non traditional crops such as silkworms, and will be looking at more natural products. It has a plant tissue culture laboratory.
- **IRST** (Institute National de Recherche Scientifique): its work on medicinal plants is detailed in annex I. The IRST department of pharmacy has an medical plant exploitation centre with extraction equipment to do trials, a steam distillation and alcohol plant, as well as a field collection of various medicinal and essential oil crops. The IRST herbarium has a collection of plant material from which some material may be sourced to provide plants for commercialisation. Its nursery propagates and supplies trees- legumes for agro forestry, fruit crops and forest trees used medicinally such as *Prunus africanus*.
- **UNR** (Universite Nationale du Rwanda) undertakes soil and foliar analyses.
- **KIST** (Kigali Institute of Science and Technology) can assist on "appropriate technology" design and manufacture.
- **ICRAF** Is a world class source of information and assistance on agroforestry, with research links in many African countries.

8.4.3. Investment Promotion

RIPA. The Rwanda Investment Promotion Agency is helpful and should be useful in finding potential entrepreneurs to manage new employment generating projects. A range of export and investment promotion incentives is available, and detailed on www.minecofin.gov.rw/investors/investment_incentives.htm In summary: new investments are allowed duty free import of capital items, those registered for Free Export Economic Zones pay a 10% company tax rate for 10 years and are allowed tax free dividend remittance. Exporters are permitted to claim drawback of duty on exported duty paid inputs.

8.4.4. Legal Framework

Government regulations are gazetted periodically, and sent to subscribers, and are available at the Prime Minister's Office. It appeared difficult to obtain concrete information from current regulations on legal requirements- e.g. the procedures for registration of pesticides, and a list of those registered, or how new medicinal products are approved for use. The Office of the Prime Minister is reported to have a library where regulations can be found, and lawyers' advice should be sought on the provisions

contained in the Code Rwandaise- Reyntjens, P and Gorus, J. (Editors) (1995), Codes et Lois du Rwanda. International consultants such as Price Waterhouse Coopers are listed in the ADAR directory and offer legal and accountancy advice. Some relevant but archaic laws- often honoured more in the breach than in the observance- but even so a deterrent to investors- seem still to be in place. For example, it is not clear whether a law taxing exports of essential oils is still in force. Revision of the code of law appears to be taking place. Details on legislation- Codes et Lois du Rwanda- are in Annex I.

Requirements for operating an essential oil still appear to consist in obtaining permission from the appropriate local authority.

There are no specific incentives within the legal framework for farming communities and intermediaries, beyond normal contract law.

8.4.5. Land Tenure

The status of landholding under the law is being amended. The system does not provide for freehold tenure of agricultural land. The problem of surveying the large number of existing holdings for formal tenure would be enormous and land sales might lead to concentration and dispossession of existing holders. Land is to be held on leases averaging 15-30 years from Government. Wetlands, which are some of the most productive soils, are often leased by the local mayors for 3-5 year terms. The Government- local and central- are helpful in supporting agricultural development plans and in making land available where possible. Clearly security of tenure would encourage long term investments in erosion control, soil organic matter improvement and fertility (rock phosphate applications can provide nutrient over a ten year period, and any organic certification programmed is a long term one). Information on legal and land tenure issues and proposals can be found on the Government website www.minecofin.gov.rw.

8.4.6. Financial Support

No significant financing of purely subsistence farmers occurs. Larger cash crop farmers have limited access to bank loans or advances from traders.

The Rural Sector Support Programme (**RSSP**) financed by the World Bank with the Rwanda Government and run in conjunction with the Ministry of Agriculture will on approved projects contribute a grant of 40% towards repayments of bank loans. Current rates of interest on bank loans of 5 years, normally fixed for the duration of the loan, are 15-18%. The RSSP aims *inter alia* to support commercial and export agriculture, with finance to exporters and downstream processing projects- $11m is allocated initially for the first phase for this sector.

The ADAR report on project funding-Repertoire des Sources de Financement au Rwanda pour L'Agribusiness, 2001 (see Annex I) gives much useful detail. Since the report was written the UK's DFID Business Linkages Challenge Fund has been extended to Rwanda, and provides funds to partnership ventures which meet its criteria- for more information see the website www.challengefunds.org . ADAR may be implementing its own cost sharing fund for small export orientated agribusinesses shortly for projects around $20,000 to $30,000.

There are a number of international funds set up to finance environment friendly projects. The London based Troodos bank, and the Shared Interest Fund are examples. Dr Turner's report on the visit to the German organic fair (Biofach) in 2002 (Annex I) outlines a source of finance (maximum 50% of total requirements) for African projects which enhance biodiversity – which includes organic production- and provides technical advice as well as funding. The fund was set up by the World Conservation Union and the IFC- web address http://kijani.org.

8.4.7. Economic Policies

The Rwanda Franc exchange rate has appreciated in real terms in recent years against the US$, and this makes the development of export or import substitution projects more difficult. The upward pressure on the exchange rate is partly an unavoidable consequence of cash aid inflows which finance some 60% of Rwanda's current foreign exchange requirements. Strong currencies tend to favour importers over exporters and local import substitution industries; and urban areas over rural. It is understood that the abolition of controls on the capital account are likely, and this would encourage investment and reduce upward pressure on the currency. Import and consumption taxes discourage investment in exports and import substitution, and encourage smuggling and corruption. Rwanda's duty drawback scheme is (as elsewhere) often seen by business managers as being too difficult to be able to access transparently and quickly and is thus ineffective.

9. ANALYSIS OF PROSPECTS FOR SUPPLY OF HIGH QUALITY NATURAL PRODUCTS IN LOCAL, REGIONAL AND WORLD MARKETS

9.1. General

The ADAR market information AgriBusiness Centre (ABC) is an excellent source of market information for potential producers and processors.

The regional market takes more of Rwanda's exports than world markets- in 2000 exports (not listed in US$- the official rate that year was 429/US$) are stated at Rfr3.7bn to the EU against Rfr8.75bn to the region. Exports, as is normal when any form of foreign exchange controls is in place, are inevitably understated.

Exports from Rwanda in 2000 in tons and US$, according to official statistics, for the major agricultural commodities were: Tea 13,000 t/$24.5m, Coffee 16,000t/$22.5m, Pyrethrum and Quinine estimated at nil for 2000 (46 tons/$3.4m and 468 tons$100,000 respectively at 1990's peak production). All other non-specified exports, including all other agricultural commodities were stated at $9.4m.

The trend in coffee production may be down as producers are finding production costs higher than returns in some instances. However where processing facilities are available and properly used, and combined with careful selection and training of smallholder out growers and a firm policy on quality grades of raw coffee acceptable, returns may be acceptable. A number of improved washing stations are planned, due largely to the PEARL station initiative by USAID.

Pyrethrum production is on an upward trend now the plant has been privatised and the managers have had time to increase plantings from outgrowers.

It is estimated that 11,000 tons of fresh passion fruit are exported annually to Uganda, 60% of which is potentially of the necessary quality for exports to world markets.

9.1.1. Entry Barriers

Medicinal Plants: Registration of exporters is required by most markets e.g. the EU, as is compliance with CITES provisions for plants listed e.g. *Prunus* and *Rauvolfia.*

Food Plants: Standards on microbial and fungal contaminations must be met- e.g. aflatoxins (overall total 5 ppb in the EU and 20 ppb in the USA) and salmonella (absent in 25g samples).

Tariffs. For most of the products considered, and into the main developed markets, tariffs are absent or token. However exporters should check tariffs for the specific markets and products.

General information on access to the EU markets is available on www.cbi.nl/accessguide and on tariffs on www.douane.nl and for the USA tariff information is on http://dataweb.usitc.gov

There is a feeling among Rwandan industrialists that the regional playing field is not level- that tariff barriers are higher than in Rwanda and COMESA agreements will not be correctly applied in Uganda and Kenya.

A "SWOT" analysis (Strength, Weaknesses, Opportunities and Threats) is set out in the report for each natural product cluster analysed, and to avoid duplication, this has been extended to cover those general to Rwanda herself.

9.2. SWOT Analysis- Rwanda General

STRENGTHS

Climatic- most tropical crops can be grown except some adapted to low altitudes

Wetlands- a very valuable resource for low cost irrigation and year round production

Fuel- intensive reforestation has been carried out, mainly with eucalypt species, and fuel wood supplies are available in some areas.

Positive attitude on the part of potential donors and customers and a perception of the country as a high altitude (so quality) grower of tea and coffee.

Investor friendly and helpful central and local government.

Low labour costs and a generally hardworking population

WEAKNESSES

Lack of entrepreneurs with capital and the needed determination to realise projects

Project finance, while available, is reportedly hard to access.

Damage to institutions and the economy still evident as a result of the events of the 1990's coupled with a wariness of possible instability in the country and region.

Landlocked position with resultant high surface transport costs.

Low level of industrial and agricultural infrastructure.

Dependence on donor funding of foreign exchange usage and consequently an overvalued currency.

Customs tariff and production tax system may favour imported finished goods over raw materials.

OPPORTUNITIES

As described under individual Natural Plant cluster headings.

In general, Rwanda should look at high value labour intensive niche crops.

THREATS

Population pressure, deforestation and erosion/reduction of fertility through inadequate inputs.

9.3. Information on Prospects and Markets for Individual Crops/Products:

9.3.1. General

Market data: Prices are estimates based on current buying prices obtained through conversations with the trade, or published statistics. Prices are CNF in US$.
Yield estimates are for low/no input small scale farming.

Tariff and other barriers to market access need to be checked for information specific to the crop and market in question. In general tariffs are low- information is available at websites listed in the report. Prior registration is needed for entry of medicinal plants in general. Standards on chemical composition and microbiological standards of products can be found at the International Standards Organisation. Aflatoxin limits are important for some crops e.g. Paprika. In general, potential customers are the best source of specific information for their commercial and legal requirements.

Most buyers will need representative samples of crops before buying, until suppliers have established a reputation for reliability and consistency. The general advice that producers should be frank with potential buyers on availability forecasts, and make supply estimates very conservatively, and take great care that samples are accurately representative- among other commonsense practices- often needs to be emphasised.

In general conventional large volume commodities are traded by many established
companies, and the best way to make contact with these is through personal introductions or trade fair participation. Markets are not particularly volatile in general, but problems at a major production country can trigger shortages (e.g. vanilla from Madagascar currently).

Price volatility tends to be a feature of spice and essential oil crops, though it is difficult to generalise. A crop failure of a plantation crop which takes some years to establish, from a major producer will have a large effect on the market price- like vanilla with the current problems in Madagascar- and this has been a recurrent feature in the vanilla market since WW II with price surges followed usually by expansion of production at other origins and an eventual oversupply and price weakness. Pepper has also been subject to wide fluctuations in price over the last few years. Eucalyptus prices have recovered to some extent from the lows of a few years ago, as has citronella.

International Standards Organisation ISO numbers are given against the individual products where they exist. British Pharmaceutical (BP) standards are important for Eucalyptus.

American Spice Trade Association standards of cleanliness are useful for reference. Standards are a guide but in practice, particularly for the marketing of organic products, the buyers will work on commonsense perceptions of quality- colour, taste, cleanliness, smell, etc., and will initially buy from new suppliers only after testing and approval of representative samples.

Microbiological standards are generally set by buyers- but on most products a requirement that salmonella be absent in a 25g sample and E. Coli in 10g is standard. A sample specification is at Annex VII.

Aflatoxin limits vary, and some markets specify limits on individual aflatoxins. UK limits are 5 parts per billion (ppb) and USA 20ppb of total aflatoxins, for example. Again, producers will need to run specific checks for to establish standards for aflatoxin susceptible crops (e.g. chillies, paprika, vanilla) for the target markets.

HACCP (Hazard Analysis Critical Control Point) systems are required by the EU for food product imports. Larger buyers can generally assist in the implementation of these and any ISO operational standards they require.

9.3.2. Essential Oils

9.3.2.1. Markets

Non-organic high volume essential oils- like geranium, citronella or eucalyptus- are normally sold into a diverse market via a large variety of brokers and traders rather than direct to the manufacturer/perfumier. Most large traders handle a wide range of oils, though some are known for their specialisation – e.g. R C Treatt in the UK has dealt in tagette oil but is best known for citrus. It is difficult to generalise on what aspect of an oil's quality makes for market acceptability and price premia. Some oils, like tagette, are bought mainly on analysis of the chemical content, or, like eucalyptus, on the content of one chemical- 70, 80, or 99+% cineole (eucalyptol). Some, like geranium, are bought often on subjective assessment- Reunion produces much less oil now, but still commands a premium over oils of other origins.

For non organic oils, the South African market takes smaller volumes and should be tried first- one buyer who has developed good links with other African countries - C.L Teubes of Johannesburg, which buys and rectifies several tons of various Eucalyptus oils p.a., has indicated interest and would be helpful in analysing samples.

EU and US buyers normally want full container loads (FCL's) as a minimum, so the SA market might make sense as a first target as volume requirements often less than FCL's. If Rwanda can establish a reputation for sustained reliability of supply, it should be reasonably easy to enter other markets for Eucalyptus and Geranium, given the relatively small production likely to come from Rwanda.

With organic oils, particularly those used in aromatherapy, it is possible to sell direct to the packer as many of these like to know the provenance of the oil and are prepared to undertake the extra work involved in imports as a result. However as the market for organic oils becomes more established, the pattern seen in marketing of organic oils is becoming more like that for conventional oils.

Buyers for organic oils (Teubes is starting to deal in organic) would include EarthOils and Ardington Resources in the UK, or Florame in France.

9.3.2.2. Production

Rwanda is probably better suited to essential oils production using small wood burning water and steam stills, where the distillation water is placed in the base of the still and direct heated by a furnace under the still. This is the type of still at ISAR. Stills which have an external steam source are more efficient- but less mobile and more expensive. If the steam volume is not adequate and pressure is not kept reasonably constant, the oil/water mix may reflux and fall to the base of the still- and be lost. More than a minimal quantity of brackish looking liquid in the base of a separate steam source still is a sign of refluxing. Steam pressure is much easier to control in an external steam source distillation system.

Approximate costs would be $5-$10,000 for a mild steel 1 cubic meter direct fired still with stainless steel coil condenser, or $20,000-$25,000 for 3 cu m stainless steel still with external 500kg per hour boiler, shell and tube condenser and an automatic control system. Prices are from quotations from Southern Africa, f.o.b., US$.

9.3.2.3. Post Harvest Treatment

After filtration and water removal, essential oils should be stored in drums lined with an appropriate lacquer. 210 liters drums (around 180 kg given the density of about 0.9 kg/liter of most oils) are the normal size for major oils. Drums should be flushed so the air in the headspace above the oil is replaced with an inert gas- nitrogen is normally used but carbon dioxide is cheaper and more easily available. In general, essential oils should be kept away from light and oxygen.

9.3.2.4. Quality Control

Samples from field distillations for analysis by potential buyers are a starting point, to establish that the variety grown is suitable. Laboratory distilled samples are not adequate- the quality will generally be different from those distilled in production stills –one reason is that the leaves are boiled in water in the laboratory flask rather than steamed. For many oils, as long as the right material is grown and distillation is carried out at a steady rate (without allowing refluxing to take place), there is rarely a problem with the quality of the oil. Analysis of production batches can generally be left to the customer- with a reference sample kept available for independent analysis in case of disputes. Some oils like eucalyptus are sold on specific chemical content and for this type of oil it is useful to have an analysis or at least a GLC (gas liquid chromatography) trace available for each batch.

Specifications have been written by various bodies for the main oils of commerce- e.g. the International Standards Institute and AFNOR (for the French market- Huiles Essentielles- Recueil de Normes Francaises). References are at Annex I.

9.3.2.5. Specific Oils

9.3.2.5.1. *Eucalyptus Globulus* and Other Eucalypts

The distribution of the various cineole rich Eucalypts needs to be determined in each area where distillation takes place so each is distilled separately. *E. globulus* (the standard eucalyptus oil for aromatherapy) is among those growing in Rwanda following some very determined re-forestation efforts. *E. maideni* is widespread and looks similar to *globulus*, with characteristic blue grey young leaves, and the upper leaves on mature trees of both varieties are often the more common eucalypt green colour. *E smithii* is a widely produced oil, and material of this species is also available. Rwanda has the potential to be a low cost producer and where existing plantations can be accessed conveniently for distillation, this oil should be viable in competition with large plantation growers elsewhere. Since leaves are usually left in situ after wood is cut, they could be collected and distilled at little cost- and can be collected for a month or more after drop- as long as they are not subjected to rain. Before distillation, leaves are difficult to compost and a mulch of uncomposted leaves can be phytotoxic. After distillation, the cooked leaf mass composts easily, and little plant nutrient is lost in the distillation process.

Two production systems can be distinguished. Dual purpose trees can be planted for harvesting of leaf and timber, or the leaf can be gathered as a by-product when timber is felled. Collection of the leaf is often the major cost of production of eucalyptus oil. Portuguese production has fallen in recent years due to increasing labour costs, and as China, the major producer, becomes more prosperous, its cost base may also increase and lead to lower output and thus opportunities for new producers.

For the organic eucalyptus market- mainly for *E. globulus* – rectification is still often not required by customers. Most conventional eucalyptus oil is rectified and/or frozen to increase cineole (eucalyptol) content to 70, 80 or a higher percentage, and to remove aldehydes and other undesirable components. This can be done in the producing country if volume justifies it, but rectification is often carried out by specialist firms- e.g. South African *E. smithii* has been processed in Australia where the undesirable iso-valeraldehyde component found a use in sheep dip. Rectification is also now carried out in South Africa, and in Portugal and Spain. In effect this means that, if produced in a country without rectification infrastructure, non-organic oil goes through a few specialist firms and then on to a wider market of traders and brokers. At a later stage it might be feasible if desired to modify the IRST alcohol distillery for rectification of eucalyptol.

Yields: Since harvesting would be from individual trees as wood is cut, and new planting is not envisaged, yield/ha figures are not really relevant- but a yield of 200 kg per ha from annually cut and coppiced unfertilised trees would be reasonable.

Uses: Cineole type Eucalyptus is a constituent of many medicinal products and used in cleaners and detergents, inhalants and other medicines and aromatherapy.

Prices: Cineole type -Organic $12, Conventional $ 4-6/kg A South African buyer currently indicated $6 CNF on an annual requirement of 10-15 tons of *E. globulus*. ISO Standard #770. Tariff Heading 33012910.

Volumes: China produces about 2000 tons of cineole type medicinal oils a year of a total world production estimated at 3000 tons, and exports about 1500 tons in total of which 571 tons were recorded as imported into the US in 2000. US total imports in 2000 were stated to be 730 tons with a total value of US$3,918m at an average price of $5.3 per kg. The statistics do not distinguish between the various types of eucalyptus oils. Perfumery type oils from *E. citriodora* are also mainly produced in China- about 1000 tons of a world market for this variety of 1500 tons. It does not appear that there are significant areas of this type of eucalypt in Rwanda. *E. dives* produces an oil containing piperitone used industrially- the main producer is South Africa with about 150 tons.

U.S. General Imports of Essential Oils of Eucalyptus (All Types) 2000

Country of Origin	Quantity imported (1000Kg)	General CIF Import Value (U$)	Price (U$/Kg)
Australia	29	247905	8.55
Austria	1	9758	9.75
Brazil	32	273996	8.56
Canada	5	5358	1.1
China	571	3020687	5.3
France	7	63417	9.1
Germany	6	49033	8.2
Hong Kong	9	69140	7.68
Jamaica	5	24680	4.93
Taiwan	55	302986	5.51
United Kingdom	13	70903	5.45
Total	733	4137863	5.645

Data from http://dataweb.usitc.gov/scripts/REPORT.asp

Reviving the distillation of eucalyptus oil is a project that could be done simply and relatively cheaply. In addition organic certification of a small area initially should be considered, and as trees are generally not fertilized or sprayed after establishment, organic production is simple.

9.3.2.5.2. Geranium

After Eucalyptus, this is possibly the best prospect of all the essential considered, and for both organic and conventional production. Organic certified oil has been scarce. Planting material remaining in Rwanda is probably all from selections of *Pelargonium graveolens*- and geranium oils from this variety form the bulk of world trade.

Yield figures reported on past Rwandan experimental plots were very good- though field trials need to be done. Planting material is available in the country which appears to have produced acceptable oils from various trial sites in the past, and records indicate good chemical composition. Geranium from IRST Butare was reported to contain: geraniol 43%, linalol 12% citronellol 17%- high geraniol and low citronellol are desirable and compare well with world competition. Samples for testing have been requested and will be needed from production as well as from laboratory scale distillation. These samples should be sent to potential customers for evaluation.

Photograph 3: Geranium at IRST Butare

Yield figures recorded for past research scale trials in Rwanda averaged over 75 t per ha fresh material, with 0.3- 0.5% oil, or up to 375 kg per ha.- probably world record yields, produced using 50t per ha manure applications or 450kg per ha of a NPK fertiliser.

These leaf mass yields would not be matched by those under smallholder conditions, and the distillation records for the ISAR still in 1980/1 show yields of around 0.06% kg oil per kg of leaf distilled (which are low- and may be due to faulty distillation techniques- 0.1- 0.2% should be achievable depending on how wilted the leaf is). Twenty tons of leaf/ha would be a reasonable crop. Oil yield may thus more realistically be 20-30kg per ha worth $1200-1800.

Geranium oil in Reunion (which normally achieves the highest prices for its output- now much reduced due mainly to higher labour costs) is mainly distilled using low cost low tech direct heating mobile distillation (i.e. no expensive separate boiler) methods, although large scale modern distillation plant is also in use there. The Reunion stills are typically 1m in diameter and 1.5 to 2m high, holding about 200kg of material, with 30cm of water in the base of the still above a perforated grid. Low cost stills as used in Reunion could make production in Rwanda easier to expand, given local expertise in unofficial distillation of banana wine spirit (Waragi). If possible samples should be distilled from these stills for analysis by potential buyers.

The USAID/IDEA Uganda report on Geranium is on the web at-
http://www.cgiar.org/foodnet/inform/Idea/Geranium.PDF

Field trials should be done to establish yields using achievable farming inputs and distillation equipment to establish accurate estimates of costs and returns. At the same time geranium planting material should be sourced externally- varieties are available which produce better oil yields at an acceptable quality.

Uses: Perfumery, cosmetics- higher quality soaps, aromatherapy.

Prices: Organic $80-100/kg, Conventional $45-55 EU Imports 200+ tones pa, average price 1999 $39. US imports 2001 US$1,787m, 43 tons, average price US$ 41kg. Tariff Heading 3301210000 ISO Standard 4731.

9.3.2.5.3. Citronella

It may be possible to generate a small market for this oil (*Cymbopogon nardus*) locally for soap perfume. Current use of around 5 tons of artificial perfume compounds might be partially replaced and one Rwandan cosmetic producer imports about 2 tons p.a. of citronella oil. Elsewhere the oil is grown on a large scale in areas where there is little land pressure, and it is likely that exports will only be viable for organic certified oils- which are in short supply at the moment. Citronella oil is not difficult to grow organically, and it would be difficult to compete with this extensively grown oil conventionally. No planting material was seen in the country but mention is made of the plant in the literature on Rwandan flora, so may be obtainable locally, and if not can be sourced from Southern Africa.

Uses: The oil is used in soaps and cosmetics, and in insect repellent candles.
Prices: Organic $25, conventional $7-8. US Imports around 500 tons p.a.

9.3.2.5.4. Lemongrass

There is plenty of planting material of *Cymbopogon citratus* available at IRST Butare. It appears to be a suitable variety, though as for the other oils, production (as well as laboratory scale) samples should be prepared and sent to potential customers.

The crop is widely grown on a large scale and there seems no particular reason why Rwanda would have a competitive advantage on conventional oils. There is a window of opportunity to become established as an organic supplier, however, but significant areas of organic material have recently been planted in Southern Africa.

The crop is susceptible to rust, but this is rarely a major problem under organic management when the plant is grown in soil high in composted organic matter.

Uses: Cosmetics, perfumery.

Yields: 10- 30 tonnes of fresh leaf material, 0.5% oil, and 50- 300 kg of oil per ha.

Prices: Organic $30, non Organic $10-13. ISO Standard 4718.

9.3.2.5.4. Rosemary

Rosmarinus officinalis is an easy crop to grow as it canopies well and so suppresses weeds and is not generally susceptible to pests and diseases. Yields of oil would be around 50-100kg per ha, at a price of about $20/kg, and a market size large enough for likely volumes of Rwandan output not to disturb the market. There seems to be a good demand currently for organic oil at perhaps $30/kg, but since the plant is grown wild round the Mediterranean Sea, world organic production can be increased easily.

9.3.2.5.5. Vetiver

As there is plant material at IRST it would be worth trying. However, when roots are lifted on from heavier soils large craters are left which may lead to erosion, and distillation is prolonged and thus fuel intensive.

The EU imported 100 tons, at an average price in 1999 of $52/kg. US imports in 2000 were $573m, for 11 tons, at an average price of $52. Conventional price is currently $30. Organic oil fetches $90-120. Tariff Heading 330126. Yields. 3-30 kg per ha.

9.3.2.5.6. Tagette

Tagetes minuta is an introduced weed which grows mainly in the first few years on reverted cultivated land- such land is not in good supply in Rwanda. The small number of plants seen appear to be similar to the Southern African variety. Test distillations should be done with samples sent to potential buyers. Extraction rates are normally 0.1-0.4%. If the material is situated reasonably close to a still and can be collected economically, the variable costs are low and production can be profitable. The world market offtake is around 15 tons p.a. and prices are $50/kg and on an upward trend.

9.3.2.5.7. Lantana Camara

This is a notorious weed worldwide- and there is a plentiful supply in Rwanda- possibly the best in Africa. Samples should be distilled on a laboratory scale, perhaps at IRST, and then on a field scale if there is interest from potential buyers. Commercialisation of a relatively unknown oil like *lantana* is a difficult process.

Further research needs to be done. Some sources of material and a summary of the characteristics are:

http://www.essential-oil.org/shop/itm01139.htm
http://www.whitelotusaromatics.com/prices/eohl.html hydro distillation for lantana
http://www.indusworldwide.com/indwrd/essenoil.htm
http://www.essentialbotanicals.com/OILS/Lantana.html
http://public.srce.hr/acphee/25900.html

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Chemical composition of the essential oil of *Lantana camara* L.

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The essential oil of *Lantana camara* L. (*Verbenaceae*) was analysed by gas liquid chromatography. The major components detected were beta-caryophyllene, a sesquiterpene hydrocarbon, and geranyl acetate, an oxygenated monoterpene. Other components include terpinyl acetate, bornyl acetate, 1,8-cineole (all oxygenated monoterpenes) and D-limonene (monoterpene).

9.3.2.5.8. *Mentha* Species

Mentha arvensis (Japanese peppermint) would grow well in wetlands but elsewhere would need irrigation and would not be economic. As far as we know there is no suitable planting material available locally. The oil is mainly used for menthol extraction- which could be done in Rwanda. So far organic menthol crystals are in limited supply. Menthol crystals are currently trading at around US$11 per kilo (conventional) for 10 ton quantities. Recommended for trials.

Mentha piperita (true peppermint) is out of its climatic range- it needs long daylength to initiate flowering, and this has been found necessary for good oil yields. It would probably grow well vegetatively in the wetlands without flowering, and could be suitable for herb tea production if grown organically (this mint is mixed with green tea for the mint tea popular in North Africa and other

markets). It may be possible to source a variety grown in Israel which is possibly less daylength sensitive and is being tried in Tanzania and elsewhere in Africa. Recommended for trials.
Mentha sachalinensis. Mentioned by Leopold Ntezurubanza (see bibliography). Should be investigated further- no information was found on this oil.

9.3.2.5.9. Ginger Oil

Ginger should grow well in Rwanda, and some is produced already. Dried ginger would be required in small quantities for a local spice industry and roots could be distilled on a trial basis. It is only likely to be viable in organic quality- competition with Chinese conventional production would be difficult. Chinese ginger oil in ton lots is currently available at US$21 per kg non organic.

9.3.2.5.10. Jasmine

Cultivar selection is important. Jasmine is a solvent (or fat) extracted product rather than a steam distilled essential oil, and needs to be processed immediately the flowers are ready- SOPYRWA might be interested in solvent extraction of crops that can be stored and processed in the out of season period for pyrethrum- and jasmine would be unlikely to fit this requirement.

Unless an extraction plant using organic alcohol were to be constructed, the crop could not be marketed as organic, and it is unlikely Rwanda has a particular competitive advantage against existing suppliers of non-organic quality.
The crop is not recommended for further work at this stage. Market: 10-15 tons imported annually to the EU, Average Price 1999 $190/kg

9.3.2.5.11. Rose

Production of this oil requires specific (not the cut flower types) varieties- principally *Rosa damascena* and *R. centifolia*, and the product is solvent extracted or produced by an "effleurage" process rather than by steam distillation. The price of the oil is high but this reflects the large quantity of material which has to be distilled per unit of oil. Not recommended for trials at this stage.

9.3.2.5.12. Other Possible Essential Oil Crops

The oils below were not covered in the ASNAPP Production Report, and further research would be needed into the availability of material in Rwanda, together with trial distillations if this can be done.

Cupressus lusitanica, *C. sempervirens*, (both Cypress). The latter is the main Cypress oil of commerce, and yields around 0.2% of oil after distillation for 15-20 hours. *C. lusitanica* requires a shorter period of distillation- around 5 hours (still longer than most oils which take 2-4 hours), and was distilled in Kenya on a large scale in the past. Like Eucalyptus, the leaf material for distillation is a by product- in the case of Cypress generally of the trimming needed annually- and the wood provides fuel for distillation.

*Matricaria chamomilla (*Camomile*).* A high priced oil. Recommended for trials.

Ocimum canum, *O. urticifolium.* The former is widely distributed in Africa, and if material can be found should be distilled for sampling. It would also be worth sending samples of oil of *O. Urticifolium* to see what interest can be generated in this oil.

9.3.2.6. Summary of Market and Production Statistics of Selected Essential Oils

	Approx Market Size (T) Non Organic		Average Prices ($)		Average Yield			Normal Non Organic minimum qty
	Import US	Import EU	Organic	Non Organic	Material per ha (T)	Oil Yield (%)	Oil per ha (kg)	
Eucalyptus (Cineole type)	733		12	4-6	20-30	1-5	200-400	Container
Geranium	50	200 +	80-100	45-55	20-40	0.1-0.2	20-30	Drum 210 litres
Citronella	500		25	7-8	10-40	0.5-1.5	50-400	Container
Lemongrass	1000		30	10-13	10-30	0.2-0.5	40-60	Container
Tagette	15 (world)			50	Wild Collection	0.1-0.4		Drum 201 litres
Vetiver	15	100	90-120	30	1-2 (dried roots)	0.3-3	3-30	Drum 210 litres
Notes: Estimates of the lower end of production ranges are made assuming Rwandan conditions (smallholder farming & nil to low inputs), and based on fresh or wilted but not dried leaf.								

9.3.2.7. SWOT Analysis- Essential Oils

STRENGTHS

- Stills exist and could be operational quickly subject to the requirements of the owners.
- New still capacity could be put in for a modest investment.
- Rwanda's production could be certified Organic fairly easily.

  Essential oils are generally easy to grow organically, and extract few nutrients from the system. Still residues contain most of the NPK from the fresh leaf and compost easily.
- Price premia are currently good for organic oils.
- There is a good sustainable supply of firewood to fuel the stills in many areas.
- Eucalyptus suitable for distillation is available as a by-product of wood harvesting.
- Acceptable plant material appears to be available- but samples of oils need to be tested.
- Some experience available locally from the period when distillation took place.

WEAKNESSES

- Lack of stainless steel fabrication capability – but still design can be modified to allow local production.

OPPORTUNITIES

- For low cost base production of oils described in detail above- principally eucalyptus and geranium. Main supplier- China- will face rising cost base if trend towards greater prosperity there continues.
- There is a window of opportunity for to establish Rwanda as an organic supplier before more major producers move in.

THREATS

- Market credibility if supply is not reliable.

9.3.2.8. Pressed/Fixed Oils

There is a local market for sunflower oil- one paint manufacturer indicated a requirement for 10 tons per month. There would be a small local market for cooking oils- groundnut oil is possibly the easiest to market as it is fairly stable unrefined. Sunflower oil can rancidify fairly quickly when unrefined but if marketed quickly after pressing, is feasible and is sold in most developing countries.

At present there are several oil press machines in the country but none appears to be functional. Bringing them into use, as well as adding to rural incomes, would develop capacity that could be used to start on production of organic fixed oils which could be exported.

The existence of an oil expression industry helps make an organic farming sector possible- the oil seed cake (the residue left after the oil is expressed) is a high nitrogen fertiliser, and particularly useful for fertility maintenance on organic plantation crops.

EarthOils in the UK would be potential buyers for organic oils.

9.3.2.8.1 Avocado

The oil production process involves crushing, heating and mixing with water, and centrifuging. Organic markets would want an unrefined oil- a help since refinery plant is expensive. It may be possible to reduce the oxidation of unrefined oil using an antioxidant such as vitamin E – this is a permitted additive under EU organic legislation. Australia is a large producer of organic oil. There are plans reported for production of organic avocado oil in Uganda and Kenya where raw material is a low or no cost by-product of fresh produce exports. Trials on a small scale would give a better guide as to what the economics are for Rwandan production. Possibly production of an organic unrefined oil might be viable, but competition with large scale conventional producers may not be.

Prices: Conventional refined $2-3/kg. Organic unrefined $18, but likely to fall as premium is unsustainably high.

9.3.2.8.2. Evening Primrose

This oilseed crop is discussed under "neutraceuticals" in the medicinal plants section below.

9.3.2.8.3. *Jatropha curcus*

This can be grown as a hedge round homesteads, and the fruit harvested for oil which can be used as a paraffin substitute for cooking and lighting- it is widely used in the Indian Ocean islands, for example. The oil is also used as a diesel fuel substitute. It should grow well, and the oil can be pressed using the same machines as those used for sunflower. The residual oilseed cake can be used as fertiliser. Seed should be obtained and bulked up for trials.

9.3.2.8.4. Sunflower

Sunflower is grown in Rwanda. As mentioned a local market exists for the oil in paints as well as for cooking oil. Several local entrepreneurs are interested in production, and if this comes to fruition it will help encourage a local industry of more specialised and organic fixed oils.

9.3.2.8.5. Neem

Azadirachta indica: oil and cake from fruits are used as an insecticide (permitted under EU organic rules), as a traditional medicine, and in soap making. Neem would be useful to have to support organic and traditional farming and should grow well in most parts of Rwanda. With the experience gained it may be a future export crop in competition with India- the main producer.

9.3.2.8.6. Castor Oil

There does not appear to be a local market for the oil- industry is not yet developed enough to generate the demand. Rwanda has no particular competitive advantage over large producers on the world market such as India, and the cake is potentially poisonous so a dedicated expeller plant is needed for safety. Not recommended at this stage.

MARKET DATA: EU IMPORTS 100,000 TONS P.A. (70% FROM INDIA), AT AND AVERAGE PRICE IN 1999 OF EURO 1/KG.

9.3.2.7. SWOT Analysis- Fixed/Expressed Oils

STRENGTHS - High price premiums for organic oils - Local market for sunflower oil
WEAKNESSES - Avocado oil- lack of fresh exports to provide rejects for low cost oil production
OPPORTUNITIES - Crops as listed
THREATS - Some donated oil finds its way on to the local market and would undercut locally produced oils

9.3.3. Herbs & Spices

9.3.3.1. General

9.3.3.1.1. Quality Standards

The American Spice Trade Association (ASTA) produces a range of manuals on cleanliness specifications, pesticide residue regulations, plant sanitation and processing equipment, and are useful reference sources for new producers. http://www.astaspice.org/ .

National standards published for herbs and spices generally do not include permitted microbiological contamination- total bacterial content per gram, *E. Coli* and *Salmonella* standards, aflatoxin and other mould induced toxin levels, etc- and these are generally set by food law or by customers. Lower levels of bacterial and mould levels are being demanded and many importers are now having to decontaminate herbs and spices with steam treatment. However, pressure for herb and spice producers to meet standards now required for dehydrated vegetables will lead to larger quantities being factory dehydrated rather than being air or barn dried on farm as is mostly the case now. Standards and specifications can be bought online from www.iso.ch . A sample specification is at Annex VII.

Spices – mainly roots, pods and seeds- are usually easier to process than herbs- leaf material that has to be dried at a controlled temperature to avoid discoloration or loss of aromatic oils, and then "rubbed"- generally milled, followed by separation of leaf pieces from stalk. Herb processing needs an investment in processing plant, while many spices can be produced by small scale farmers and dried and cleaned on farm without the need for further processing.

9.3.3.1.2. Post Harvest and Storage Treatment

Good hygiene in field and store is the first precaution against insect infestation. Non organic crops should be fumigated with a permitted fumigant on arrival and then every 3 months in store. Organic stored crops can be protected by a combination of carbon dioxide fumigation, heat treatment and freezing. Detailed instructions can be provided by the consultants.

9.3.3.1.3. Marketing

Conventionally grown capsicums- paprika and chillies- could be marketed via Southern African agents. These are now the main suppliers to oleoresin extractors in Spain. The Southern African region now produces a large part of the crop formerly produced in Spain before entry to the EU and a general increase in prosperity raised wages to the point where the crop became uneconomic in that country.

Current problems in Zimbabwe will leave a gap in the market until the rest of the region takes up the slack. Marketing agents normally contract growers, provide seed and advice, test the crop supplied for colour value, heat units, moisture etc. and arrange containerised exports of baled pods.

Organic herb and spice crops could be marketed through South African buyers such as Cape Herbs and Spices, and EU outlets such as The Organic Herb Trading Co in England and Euroherb in the Netherlands, or Frontier Herbs in the USA. Forestrade would be a useful contact- they work with smallholder farmers in spice producing countries- www.forestrade.com

Buyers will specify the type of packaging required. In general spices will be shipped in hessian or polypropylene weave outer bags with plastic inner liners, and the weight is normally 50kgs. Herbs, which are less dense, will be sold in the same size bags weighing 20-25kgs. Fumigation requirements vary with the product and market. For example all imports to Australia have to be accompanied by a fumigation certificate, but this is not a requirement for the EU. Birds eye chillies and paprika (deseeded) would normally be sold by the container load- a 40' container takes 148 bales of 120kg paprika, or about 18 tons.

Our recommendations that herb and spice crops other than capsicums should be grown organically, and for this quality, in general, there are no minimum requirements for shipment sizes.

9.3.3.2. Specific Herb and Spice Crops

9.3.3.2.1. Birds Eye Chillies

These very hot chillies have been grown for some time by smallholders in Rwanda. For the local market the chillies are used in pastes mixed with mangoes and other fruits- the main condiment used in Rwandan cuisine. As a labour intensive lower volume crop it would be suitable for Rwanda. Price is partly based on capsaicin (heat/pungency) content- 1% is an average content, and birds eye chillies are among the hottest cultivated varieties. The main non organic market is for extraction of oleoresin used in liniments and anti-assailant "mace" type sprays. Spice companies use smaller quantities of the dried chillie – few EU spice companies would use more than a few tons per annum. Two Zimbabwean companies have expressed interest in looking at contracting Rwandan growers and marketing birds eye chillies.

Yields under Rwandan smallholder conditions might be 600kg-1.5 tonnes per ha, and prices currently are around $1-1.50 for non organic top grade (70% of the crop in smallholder farming in Zimbabwe) and 60-80c for second grade.
There is a small market for organic quality. Organic prices are $3-5 per kg, and the chillies are used for spice mixes and condiment pastes.

9.3.3.2.2. Paprika

If SOPYRWA can extract paprika oleoresin in the off season when it is not processing pyrethrum and the result be solvent stripped elsewhere to give acceptable residue levels - a maximum of 25ppm (parts per million rather than the 1.5% hexane left in the pyrethrum extract) -then the transport cost disadvantage Rwanda has would be minimised. There are extraction plants in Zimbabwe and South Africa, and indications from the Zimbabwe plant, Paprika Zimbabwe, are that they would be prepared to do the solvent stripping in their off season- December to March. The Southern African countries are able to grow paprika on large acreages on a high input/high yield model, with good colour values. Paprika pod is bought by extraction plants on the basis of ASTA (American Spice Trade Association) units - a measure of the colour value of the crop.

Contacts have been made with a Zambian company which markets bulk paprika to extraction plants, and it is hoped that a trial crop will be grown shortly to test viability of the crop in Rwanda.

There is also potential to grow an organic crop, and at the moment prices are good- 2-3 times the non-organic prices.

Yields under local conditions might be 600kg- 1.5 tonnes per ha, and prices for conventional paprika at the grades achievable would currently be $0.50-$1.50. Commercial farmers in Southern Africa achieve up to 7 tons per ha, and prices for the higher ASTA colour grades are considerably higher.

9.3.3.2.3. Vanilla

Vanilla is normally grown up to 600m elevation in the tropics, with around 2m or more of rain and mean temperatures of 25 deg C, traditionally in littoral environments.

Uganda has become a large producer – the USAID/IDEA report at the website below estimates 1998 exports at 30 tons and anticipates a crop of 100 tons currently. http://www.cgiar.org/foodnet/inform/Idea/Geranium.PDF

A good guide to the market: http://www.marketag.com/ma/bulletins/market/vanilla.stm. World market size is generally estimated at about 3000 tons p.a. of cured beans, and prices of $150 per kg are currently being achieved against a shortage caused largely by a reduction in the Madagascar crop. Supply will inevitably increase again and prices fall. Organic vanilla is still scarce.

Uganda is generally lower lying and so a more suitable production area than Rwanda, with higher rainfall sites at lower altitudes. Rwanda may be too high to achieve top yields but trial plantings of a few vines in various areas under nursery conditions with irrigation should be undertaken at low cost to see if the crop is viable- as a labour intensive crop it probably could be made to succeed. So far we have seen 2 vanilla plants in Rwanda- under the eye of Dr Schilling of the PEARL Project in Butare Other nursery areas that could be used to bulk planting material and monitor results are the tree nursery at IRST Butare, and ISAR. Planting material could be given to any nursery that appears competent to look after the plants- in particular they must be in humid, well watered conditions under shade or in hothouses.

Once it has been shown likely that the crop will grow acceptably well, areas that might be suitable for subsequent small trials are:
Bugarama. Dry Forest 900m average temp 24 Deg C rainfall 1100mm.
Rubona Sub humid Forest 1700m average temp rainfall 1150mm (and if successful much of the central part of Rwanda also).
Mwaga Humid Forest 1560m average temperature 19 Deg C rainfall 1900mm. Used to be forest but has been cleared.

A visit was sponsored in 2001 by ADAR to ADC Uganda– a brief report was written by Umran Kaggwa. Vanilla cuttings cost Uganda sh500/US$0.35c plus transport. Vanilla is grown at Mukono and Nabuti in Uganda. A demonstration plot was funded by USAID/ADC. A Uganda National Vanilla Association exists.

9.3.3.2.4. *Lippia Multiflora*

Used as a herb tea in West Africa. Some *lippia* species available in Rwanda may be commercialisable (Advice from Leopold Ntezurubanza- a noted authority on Rwandan flora- see article www.Idrc.ca/report/read_article_english_.cfm?article_num=1063).

9.3.3.2.5. Chamomile

A widely used herb tea- but still a relatively small volume crop and other African countries such as Tanzania are expanding production. The crop is picked and dried in the same way as Pyrethrum, and could provide an additional labour intensive cash crop for their farmer network and drying facilities. It is easily grown from seed. Recommended for trials and bulking up on Organic basis.

9.3.3.2.6. Lemon Verbena

Propagated from cuttings- seedlings are harder to establish. A small volume herb tea. Some material is available in Rwanda. Recommended for trials and bulking up on Organic basis.

9.3.3.2.7. Hibiscus

Hibiscus sabdariffa. Used in herb teas to and gives a tart, fruity flavour. Popular in Germany. **ASNAPP** has done detailed work on this and many other herb tea crops- see: http://www.asnapp.org/library/Hibiscus.pdf . Worth including in trials for organic propagation of selected material- not all varieties are acceptable in the market.

9.3.3.2.8. Lemongrass

Cympobogon citratus ("citronelle" is used for both Citronella (*Cympobogon nardus)* and lemongrass in French- which can cause confusion. Used in herb teas. If the crop is grown for lemongrass oil the dried leaf gives and extra marketing option. Organic leaf is currently fetching around $2 per kg.

9.3.3.3. SWOT Analysis- Herbs and Spices

STRENGTHS
• Local market mainly supplied by imports giving an opportunity for import substitution
WEAKNESSES
• Transport cost disadvantage vs Southern Africa • Lack of manufacturing base to construct industrial scale dryers and processing equipment
OPPORTUNITIES
• May be possible to process Paprika or Chillie oleoresin in Rwanda
THREATS
• Microbiological standards for herbs may be hard to meet under small scale production conditions.

9.3.4. Medicinal Plants and Non Wood Forest Products (NWFP's)

9.3.4.1. General

The pressure on existing forest resources would make wild harvesting for exports of both medicinal plants and NWFPs difficult to sustain.

Two types of medicinal plants with potential for exports can be distinguished:

- Plants serving as raw materials for licenced medicines- *Prunus africanus,* quinine*, Datura stramonium* etc.- ("Pharmaceuticals"- in this report).
- Plants used whole or extracted for "food supplements" – ("Neutraceuticals"- in this report)- such as Evening Primrose, Yohimbe, Echinacea etc.

9.3.4.2. Pharmaceuticals

As discussed in the ASNAPP Production Report, there is little sustainable supply of medicinal plants for collection from the forests, and potential export species would need to be cultivated where feasible. This is in contrast to other Central and West African countries where there are large areas of uninhabited wilderness areas and resources are sufficient for properly controlled wild harvesting to be sustainable.

Given the lack of sustainable wild harvestable medicinal plants, it is difficult to see where the cultivation of pharmaceuticals would have a clear comparative advantage for Rwanda over its central African competitors. Unlike other crops competing for cultivated land, there is no real market for organic certified medical plants for extraction into registered medicines- though there is a strong marketing advantage for certified organic neutraceuticals.

Pharmaceuticals exporters need to be registered to sell medical plants to the EU- the regulations are listed in the **CBI** Guide to Natural Ingredients for Pharmaceuticals (Annex I).

9.3.4.2.1. Summary of Past Rwanda Work on Pharmaceuticals

Much of the very extensive work that has been done on Rwandan medicinal plants is described in the scientific literature listed in Annex I. These publications are in general available in the IRST library at Butare. The local consultant will be able to help in sourcing material in cases where it is no longer available in libraries.

IRST has done considerable work on commercialising medicinal plants grown in Rwanda. This includes an anti-spasmodic syrup from *Datura stramonium* (Gifurina), anti-cough syrup from *Plantago lanceolata* (Bentakor), cough syrups from the mixture of *Eucalyptus globulus* and *Datura stramonium* (Tusinkor), and from *Eucalyptus globulus, Datura stramonium* and *Thymus vulgaris* (Tumitusilinga), a mouth disinfectant solution from *Eucalyptus globulus* and *Mentha sacchalinensis (*Kanwalina), an anti-arthritic formulation from *Capsicum frutescens*, an anti-inflammatory ointment from *Calendula officinalis* (Calendula) and an anti-scabies ointment 'Tembatembe A' containing a rotenone compound from *Neorautenenia mitis*, which was used successfully on prisoners. IRST's Centre de la Pharmacopée is in the process of registering the medicines with the Ministry of Health which should formally allow legal sales. An inspection team from the MoH has visited the Centre and the updated booklet describing their medicine requested by the Ministry has now been submitted.

9.3.4.3. Specific Medicinal Plants

9.3.4.3.1. *Prunus Africanus*

This plant, whose bark (the extract is used in the treatment of prostate cancer) has been exported in the past, is listed in Cites Appendix II, (as are many major traded medical plants including *Rauvolfia serpentina*, *Panax ginseng*, *Aloe vera* etc.), but as mentioned in the **ASNAPP Production Report**, sustainable collection does not appear to be feasible unless supported by cultivation.

A nursery of *Prunus africanus* seedlings is being managed by ISAR/ICRAF. The ICRAF regional office in Nairobi has done considerable work on the tree.

ISAR/ICRAF are planning to plant 1-2 ha of *P. africanus* in Gishwati forest, and have ¼ ha in Butare (Arboretum), as well as seedlings in the Butare nursery.

9.3.4.3.2. Quinine

(*Cinchona* spp.) According to official figures, the bark of this tree was exported until recently. It is reported that a factory was established for extraction of the bark in Rwanda but not commissioned. With the increase in multidrug resistance of malaria strains, there may be a growing market for natural quinine as well as its synthetic counterparts.

9.3.4.4. Neutraceuticals

9.3.4.4.1. Evening Primrose

Some *Oenothera biennis* plants were growing at IRST . Its small seeds yield a high value oil, and the plant should grow well in Rwanda. No information has been seen on trials on this crop, but it has been introduced and may well have been tested in the past. The organic oil is high value- perhaps $25 per kg. Harvesting is labour intensive. It is used as a food supplement - taken mainly to relieve pre-menstrual tension (PMS/PMT)- and in skin care products. It is recommended that a suitable variety of seed be imported for trials alongside the existing varieties- conventional buyers generally aim for an oil with a minimum content of 10% GLA (*Gamma Linolenic* Acid). The seeds contain about 20% total oil, of which about half can normally be extracted. A high efficiency press is needed- there is reported to be one Komet machine in Kigali which is yet to be commissioned and might be available. Conventional production is dominated by China. Only recommended for trials for organic production.

Photograph 3: Evening Primrose at IRST.

9.3.4.5. Non Wood Forest Products ("NWFP's")

The arguments relating to the sustainability of wild harvesting of medicinal plants applies also to NWFP's. None are identified in the associated **ASNAPP Production Report**. The comprehensive report of the **FAO/EU -Les Donnés Statistiques Sur Les Produits Forestiers Non Ligneux Au Rwanda**- reviewed in Annex I lists wild mushrooms as possibilities, and further investigation of the supply of these may be worth pursuing. Wild harvested *chanterelle* and *amanita* species have been exported from Southern Africa for many years.

9.3.4.6. SWOT Analysis- Medicinal Plants

STRENGTHS • Much work has been done in the past and traditional knowledge still exists.
WEAKNESSES • Local legislation makes commercialisation for the local market a long process.
OPPORTUNITIES • No immediately exportable product seems to be available. The longer term process of selection and trial cultivation seems the only way forward. • Cultivation of promising species may give Rwanda an eco-marketing advantage over wild harvested competing product.
THREATS - Continued deforestation may make any wild harvesting impossible.

9.3.5. Value Added/Processed Food Products- Organic and Conventional

Some possible new products have been covered in detail in previous work e.g. the CIRAD report (Annex 1). A further study is likely to be done on value added and organic products.

9.3.5.1. Local Market

The local market imports most of its dried spices for bulk and retail sale and an opportunity exists to start with the small local market as a way of getting into the regional market in time. Processed sauces like Ragout/Pasta Sauce, Baked Beans (in glass jars as there is no cannery), Basil Pesto etc. could be processed and marketed locally.

9.3.5.2. Dried Organic Tropical Fruits

There would be a fair trade/organic market for dried tropical fruits- this is the subject of a forthcoming study so is not examined in detail. It would be a suitable candidate for a Rwanda specific ("The Gorilla") brand where a percentage is paid to help protect the Gorilla. Uganda exports dried fruits to a number of Fair Trade importers like www.fmfoods.co.uk – Trademark "Fruits of the Nile". Kipepeo- www.kipepeo.com markets 75g packs of bananas in a standup plastic "Doypack"- IMO certified to EU rules. Cooking bananas could be successfully promoted into the EU markets- at the moment the small supply is aimed at the ethnic market, but as alternatives to potatoes and other starch there is a much bigger market available for fresh and possibly dried cooking bananas.

9.3.5.3. Specialty Exports

There are opportunities to export traditional specialties like Pili Pili, banana liqueur, cassava flour, etc . into ethnic markets as well as exotic sections in supermarkets in the EU, alongside branded tea, and coffee etc which all make use of the recognition of Rwanda as a region of volcanic highlands and lakes. The success in the UK market of the South African specialty "Amarula" fortified *digestif*, which is base on the marula fruit, could serve as a marketing model for a Banana based liqueur. Specialty foods sold as regional African traditional foods have a place in the EU's supermarkets- e.g. a range including "Zulu Fire" chillie sauce and "Malawi Gold" curry sauce etc,- made by Ukuva in Africa- in the UK is sold in Sainsburys supermarkets.

9.3.5.4 SWOT Analysis- Specialty/Value Added/Organic Products

STRENGTHS • The existence of an expatriate/immigrant market in the EU and elsewhere.
WEAKNESSES • Small market which might be hard to target.
OPPORTUNITIES • As listed above
THREATS • Production of ethnic specialty foods in target markets, replacing imports

9.3.5.5. Organic Markets and Certification Regulations

9.3.5.5.1. General

Rwanda's advantages in the area of organic production have been discussed. Finance and consultancy assistance is available. Rwanda is probably best as a niche producer. For these and other reasons, most of the export crops selected for further action in this report are for organic production.
A general guide to organic certification requirements is included for reference.

9.3.5.5.2. Organic Standards and Certification

Organic certification makes marketing of smaller volumes much easier, and sales direct to users or with less middlemen and higher margins more likely. In general a price premium is obtainable provided quality standards are as good as conventional produce.

The question of what is involved in obtaining certification, and an explanation of the rules are set out comprehensively in Dr Turner's report on preparation for certification. (**ABC/ADAR**. Pre-Inspection Preparation for Organic Certification and Biofach Organic Fair report, Dr A Turner. 2002).

The regulation for EU certification is 2091/92 as amended. This is a very comprehensive document- but it describes a workable, real world system, and in essence the requirements are reasonably simple. Individual certification agencies may have their own regulations which may be more restrictive than the EU regulation.

The choice of certification company should be made on advice from potential customers. The EU approves Certification Authorities who are delegated to inspect and issue certification. Some well known bodies are the Soil Association in the UK, Ecocert in France and Germany, and Krav in Sweden. Inspectors visit organic sites at least annually, produce a control report on the producer or processors, and if this is approved, an organic certificate is issued. Importers of organic produce have to be registered with the appropriate national authorities and submit lists of each product imported. The exporter must complete an export certificate for each export consignment. Certification rules are similar for most developed markets, but it is necessary to make sure the importer's certification agency has made an agreement to accept the exporters certification. The process of obtaining such agreement can be time consuming, even within the EU, and involves making the inspection reports available to the importer's certification agency.

Full records of all operations and transactions have to be kept to permit audits to ensure non organic inputs are not used, and fraud is made less likely as land under each crop is recorded and yields can be checked against norms. Soil and plant analyses to check for fraud are unusual but can be required. A transition period of at least 2 years is needed from the date of the last use of non permitted inputs- 3 years in the case of plantation crops. Some agencies may be prepared to certify land that has been fallow for the required time as long as independent confirmation is available.

Only specified inputs may be used. These are listed in Annex II- but in summary, generally no soluble chemical fertilisers may be used (but potassium sulphate is permitted if the certification agency agrees it is needed). Rock phosphate (vital for successful results in most tropical soils) is allowed, as is vegetable matter such as oilseed cake (again very useful particularly as a source of nitrates). Some high protein cakes e.g. soya with 36% plus protein has about 6% N- the ratio being roughly Protein: N 6:1. Lime and legume rotations may be used. Pest protection is limited to low persistence traditional insecticides like natural pyrethrins (but not artificial pyrethrins) and derris; and for fungal diseases sulphur may, for example, be used.
Most organic producers seem to find that organic farming is not as difficult as it looks beforehand, and that the difficulties are often more in fertility management rather than pest control.

The cost of certification varies widely. In the initial phase an inspector needs to be brought in (accommodation can be done in private houses- the inspector will usually agree to this) and the cost shared between those applying for certification. A quote will be given in advance, and the final charge may vary depending on the work found to be involved. Daily rates for the inspection are around $300-500 per day, and there will normally be at least 2 days at similar rates for report writing. The Agency will normally charge for 2 days for a simple inspection. Excluding airfares and accommodation, certification might cost $2500 for a producer with 6-10 sites to visit in reasonable proximity to each other. Clearly, the more prepared the producers are with their paperwork, the lower the cost is likely to be. At a later stage the certification agency may appoint a local inspector if the volume of inspection work justifies this.

9.3.5.5.3. Organic Market Statistics

A useful source of Organic market information is:
Organic Trade Services, www.organicts.com/

The International Trade Centre ITC has some very comprehensive reports on organic markets on its website www.intracen.org/mds . **The United States Market For Organic Food And Beverages, by** Mr. Rudi Kortbech-Olesen, Senior Market Development Adviser, ITC. In summary:
While there is little or no information available on the actual size of U.S. imports of organic products, but the retail market for organic food and beverages can be estimated at about $8 billion in 2000, according to various industry sources. According to *The U.S. Organic Food Market* (November 2000), prepared by *Packaged Facts* report (see www.MarketReseach.com), the organic market increased from $ 6.5 billion in 1999 to $ 7.8 billion in 2000, a 20% increase, and is expected to reach $ 20 billion by 2005.

According to another survey *Organic Consumer Trends 2001* (published jointly by *The Natural Marketing Institute* and the *Organic Trade Association* in May 2000), retail sales of organic products have grown at a compounded annual growth of 22.74% over the past ten years and by 24.72% over the last three years. They projected retail sales of $ 9.3 billion in 2001 and also expect sales to reach about $ 20 billion by 2005. See table of contents and executive summary at www.nmisolutions.com.

A useful study on the EU organic market is:
EU: First OMIARD Report The 'Analysis Of The European Market For Organic Food' 31 July, Organic Wales Bulletin No 11, http://www.organic.aber.ac.uk/
Some excerpts:

- It is still virtually impossible to obtain accurate data about the organic market from official statistics.
- Organic products share of total production in the EU remained low for all products in the survey, ranging from 0.2% for organic pork up to 2.3% for organic fruit.
- On average, Denmark and Austria had by far the highest organic share of total food production in 2000, with 6% and 5% respectively. The lowest organic production shares were recorded in Spain, Greece and Ireland, with the organic share of total production at less than 0.4%.
- In 2000 EU was a net importer of cereals, oilseeds, potatoes and vegetables, beef, sheep and goat meat and a net exporter of organic olives and organic wine, organic milk and especially of cheese.
- The EU average for consumer price premiums in 2000 varied from 31% for organic red table wine up to 113% for organic chicken.

10. RECOMMENDATIONS

10.1. General Recommendations

Previous reports contain much information and many recommendations have been made as to which crops could be grown in Rwanda. This report reviews this information, and provides recommendations for action on ASNAPP specified natural product groups.

Projects such as the distillation of essential oils could be initiated very quickly given the requisite entrepreneurial drive- for example the still at ISAR could be repaired and back in use in a week or so from the time the decision to go ahead was made, and eucalyptus leaf is available in the area and could be distilled.

A detailed plan, together with implementation recommendations, is envisaged as the next stage in the ASNAPP project. Estimates are given in the report for some items of capital equipment such as distillation plant, but detailed costings would have to be estimated in conjunction with specific project implementation plans.

Even within a product "cluster"- e.g. spices- individual crops will need different approaches. For example, non organic capsicum crops can be developed in conjunction with contracting/export marketing companies who will provide seed and agronomic advice and handle shipment. Organic crops should be developed in conjunction with overseas marketing companies and would require a local entrepreneur to contract and ship the product. Some spices would be viable if grown for a local and regional market, and again implementation would be different from spices grown for overseas export.

10.2 Specific Recommendations

10.2.1. Management: Co-Ordination, Progress Chasing and Pilot Projects

A manager should recruited and be made responsible for implementation and follow-up of the recommendations of the report that are selected for action. ASNAPP has a regional co-coordinator in Southern Africa, and this might be a model for this Central African initiative.

The pilot coffee pulpery/washing plant set up by the USAID PEARL project could serve as a model of the way the projects suggested in this report might be made to happen.

Recruitment of external expertise to revive or initiate projects prior to handover to local investors may be required where local expertise is not available. If so, project managers could be found in Southern Africa at a lower cost than might be incurred by bringing in EU expertise.

10.2.2. Revive and Expand an Essential Oils Industry

10.2.2.1. General

A more detailed analysis of the various possibilities is given later in the report. An obvious initial choice of crop is eucalyptus essential oil. Eucalypts of suitable types are in good supply in some areas, the leaves are generally waste product after the timber is harvested. The timber provides a source of fuel for distillation. The next target would be geranium, and the varieties present need to be assessed by testing field distilled samples along with those of the eucalyptus varieties available.

These two oils should be viable if marketed as conventional, but should be certified organic if possible. If organic status is obtained, citronella and lemongrass together with the other minor oils discussed in section 9 of this report should also be viable. Trials should be done on herb oils with planting material obtained locally or imported, and propagated in selected nurseries. Distillation facilities already exist and could be brought into production if a plan can be made with the still owners IRST and ISAR.

Further work will be needed to design direct heat stills suitable for manufacture and use in Rwanda for small projects, and from Southern Africa or Europe, etc., for larger capacity stills with separate steam generation units.

10.2.2.2. Outline Essential Oils Implementation Plan:

ACTION	APPROX TIME
Samples of existing material field distilled by IRST/others for testing by potential buyers.	1 month
Plan with owners for possible use of existing stills	1 month
Entrepreneur/Co-coordinator selection and training.	1-6 months
Obtain still designs and costings Manufacture or import pilot plant if ISAR/IRST stills not available. 1500 liters capacity, direct fired. Approx cost $7500. 8,000 liter still with external boiler $25,000.	1 month 3 months
Crop production and distillation guide written on specific crops chosen.	3 months
Planting material sourcing, procurement. Cost of seeds variable, plant material US$ 50c per cutting. Selection of nursery sites and propagation. Examination of existing distillation material availability- including mapping of varieties of eucalypts available with likely annual leaf availability.	3 months
Farmer selection and organic certification. Ruhengeri, Byumba and Butare areas suggested.	6 months
Trials on selected sites- one as a model nursery/distillery.	12 months

10.2.3. Start/Expand Herbs and Spices Production

The production of capsicums should be expanded- birds eye chillies would be viable for dried pod export. Paprika should also be viable especially if an intermediate extract can be made at SOPYRWA. Organic paprika is in demand. Other spices where an export market is envisaged should generally be grown organically to give local production a competitive advantage. Trials should be done on spices detailed below like vanilla (which would be growing out of its conventional ecosystem), pepper, coriander, ginger, turmeric, etc. Herb tea crops such as lemon verbena and chamomile should be viable. Some of these crops would in any case be useful to have available as a base to help start a spice packing and food processing industry to serve the region.

10.2.3.1. Outline Herbs/Spices Implementation Plans

10.2.3.1.1. Capsicums- Non Organic

ACTION	APPROX. TIME
Contact potential marketing companies to arrange visits to Rwanda.	1 month
Identify existing and potential growers of chillies and potential growing areas.	3 months
Entrepreneur selection- possible partners in operating grading and packing station which would arrange containerised shipment- in liaison with selected marketing companies.	3 months
Select, obtain and test drying and processing equipment	3 months
Seed sourcing, propagation and planting out	6 months

10.2.3.1.2. Organic Herbs and Spices

ACTION	APPROX TIME
Liaison with potential buyers overseas	1 month
Farmer selection and organic certification	6 months
Planting material and seed sourcing and propagation	6 months
Trial area production- output sold for local marketing of prepacked herbs and spices	6 months
Crop production guide written on specific crops chosen.	3 months

10.2.4. Start a Small Value Adding Spice/Dried Fruit Packing/Condiments Processing Industry

While the local market would be small, the business should be viable given the cost of imports and might result in eventual exports to the regional market and beyond. Spices could initially be packed in 50-75ml capacity sachets. There are niche markets available for regional specialties- cassava flour retail packed to the EU is being examined. Banana liquor, Gorilla brand pili-pili are possibilities.

Organic solar dried tropical fruits marketed retail packed in conjunction with a Fair Trade/Organic overseas partner should be viable- Ugandan producers are already in production.

ACTION	APPROX TIME
Liaison with potential buyers/distributors local and regional.	3 months
Processor selection.	2 months
Product and packaging development.	6 months
Product trials.	3 months
Organic certification for processors once organic crops available.	3 months

10.2.5. Establish an Oil Press Industry

This has been done successfully in most developing countries, both on a rural and urban basis. There is a small local market (20 tons per month minimum) for industrial use of oils like sunflower, and a small local market could be made for groundnut and other cooking oils. Hand and simple machine powered presses designed for low maintenance use in developing countries are widely available from India, UK and Southern Africa. There are several machines in the country already which do not appear to be in use yet. Export of organic oils such as evening primrose may be possible on the back of a local expression industry, and the oilseed hulls and press cake are valuable organic fertilisers, particularly for perennial crops. Several entrepreneurs have indicated that they have plans to start production.

10.2.5.1. Outline Oil Press Implementation Plan

ACTION	APPROX TIME
Liaison with potential buyers/distributors local and regional	3 months
Processor selection and advice on oil press and ancillary equipment sourcing. Advice to existing owners of presses not currently used.	2 months
Advice on oil processing and storage methods.	2 months
Product trials.	3 months
Processor organic certification once organic crops for processing available.	3 months

10.2.6. Subsidiary Recommendations

10.2.6.1 Information Access

For anyone who has a computer and modem, the web is the easiest library to visit. The results of the enormous amount of work already done on identifying opportunities, writing crop production guidelines, detailing sources of funds and other work should be made easier to find by including selections on a website, perhaps as an add-on page to another website initially. CGIAR (who host ADAR's sister Uganda technical co-operation IDEA project's crop commercialisation guides) may be a possibility. Project opportunities as selected from recommendations in this and other reports should be listed on the website- possibly in liaison with the Rwanda Investment Promotion Agency. . Some of the reports listed below may have sections which are confidential regarding individual companies, and here reports would need to be suitably edited before posting to the website. The website should also have links to relevant sites such as Rwanda's legal and investment promotion framework, sources of credit, exporter associations, and agronomic guides.

10.2.6.2. General Crop Production Improvement

The low yields currently achieved on most crops in most parts of Rwanda are an obstacle to promotion of new crops which will have to compete with farming for subsistence. Given Rwandan population pressure and the country's reliance on agriculture, assistance on improvements to the extension services, facilitation of access to inputs and crop finance, etc., must be a high priority. It is notoriously difficult to promote adoption of well tried methods which involve long term land management in a situation such as Rwanda's- with all the limitations of lack of capital, uncertainties on length of tenure, etc.

Promotion of a low cost input system of agriculture (distinct from the current generally very low input system) would involve most of the same concepts as organic farming, and could best be started as part of the current organic certification programme. Depots where organic inputs could be purchased (rock phosphate, pyrethrum sprays, rhizobia innoculants for legumes, legume seeds for nitrate fixation through intercrops or rotations, etc) should be established.

A manual should be written to describe the methods of organic/low cost input crop production recommended. This would include recommendations on how to use, under Rwandan conditions, inputs permitted under organic certification regulations- such as rock phosphate, lime, sulphur and nitrogen fixing rotation and intercrops- and for crop protection using permitted natural chemicals like pyrethrum and tephrosia. The EU list of permitted organic fertilisers and crop protection chemicals is at Annex II. Production handbooks for individual crops should also be written. This process has started with the ADAR manual on Passion Fruit production written by Dr A.Turner. Liaison with extension services in the production of these manuals would start the process of education of conventionally trained extension personnel in organic/low cost input methods. The manual might be made available on the internet.

10.2.6.3. Other Areas for Future Investigation/Technical Assistance

These should include:

- **Fish farming** (currently most fish are imported, while there are many unused lakes in Rwanda).
- **Wind pumps** (in many areas water has to be carried to plots and houses, limiting seed bed establishment to the rainy seasons, and irrigation might be possible around some lakes).
- **Papyrus**- use of the large areas of this plant to start a hand made paper industry ("scrolls from the source of the Nile").

ANNEXES

ANNEX I: BIBLIOGRAPHY AND LITERATURE SUMMARY

1. ASNAPP TARGETED NATURAL PRODUCTS (ORGANIC CROPS, SPICES, CULINARY HERBS, HERB TEAS, ESSENTIAL OILS)

- **ABC/ADAR**. Pre-Inspection Preparation for Organic Certification and Biofach Organic Fair report, Dr A Turner. 2002. Comprehensive guide to prepare growers for Ecocert inspection.
- **ABC/ADAR.** Assisting Rwandans with Entry into the International Organic Market Place for Tropical Fruit. Dr A Turner. 2001.
- **ABC/ADAR.** Progress Report on Export of Passion Fruit, **Birds Eye Chillies** and Tamarillo. Dr A Turner. Draft July 2002. Includes title "Comment Produire le Maracuja pour l'Exportation". Practical production guide for the crop under local conditions, including advice on disease mitigation through correct field hygiene procedures.
- **IRST/Centre Pharmacopée**. Kagangwe, V., Kamanzi J.B., Makarusine Eu. Essais de Culture et Production de L'Huile Essentielle de Pelargonium graveolens. 2001. Shows high yields of leaf and oil with desirable characteristics- but done on trial areas with high inputs.
- **Philips L.B**. Perspectives de Production d'Huiles Essentielles au Rwanda, Butare, 1988 (Quoted by IRST ibid). Rapport soumis au Centre de Développement Industriel (CDI). Philips was from APV Project Ltd. 58 pages.
- **Ntezurubanza, Leopold**. 'Les huiles essentielles du Rwanda'. LASEVE (Laboratoire d' Analyse et de Séparation des Essences Végétales) 2000 The author is an expert on the Rwandan essential oil industry. Pre-independence Geranium and Eucalyptus were the most widely produced oils (North, North West and South West of the country). There were 6 businesses producing Geranium oil that were selling to the local soap industry as well as exporting to Europe and Africa. Geranium also grew in Kabare (Tare, Kigali) and Byumba. Post independence, farmer cooperatives were created but production declined and then ceased. Other essential oils suggested for trials were: *Artemisia dracunculus* (tarragon), *Cupressus lusitanica*, *C. sempervirens*, (both Cypress) *Cymbopogon citratus*, *Matricaria chamomilla (*Camomile*)*, *Mentha sachalinensis*, *Ocimum canum*, *O. urticifolium* and *Tagetes minuta* (Tagette). The pilot project was to follow the model of the time with an expatriate as project manager with his Rwandan counterpart. A budget for the project was suggested. The techniques of growing and distilling the plants were well described. Comparisons of different sources of available energies were made as well as income from essential oils and Rwandan conventional food crops.

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- **ISAR** (1977). Compte- Rendu des Travaux du Département Laboratoires 1977. 19 pages. The report contains informative data on essential oils (Eucalyptus smithii, E. globulus, E. dives, E. citriodora, E. macarthuri, etc..) which were being tried at that time. The extraction of avocado oil has also been tried using a hand press and 40% of avocado oil was obtained. Probably at that time the still in Rubona was up and running.
- **ASNAPP/USAID/Rutgers University.** Botanicals and Natural Products in West Africa. A.O. Adelaja J. E. Simon B. J. Schilling D. Acquaye. 2001. Comprehensive review of production, export markets and statistics for pharmaceutical and neutraceutical crops.
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- **ISAR** (1977). Compte- Rendu des Travaux du Département Laboratoires 1977. 19 pages. The report contains informative data on essential oils (*Eucalyptus smithii, E. globulus, E. dives, E. citriodora, E. macarthuri*, etc.) which were being tried at that time. The extraction of avocado oil has also been tried using a hand press and 40% of avocado oil was obtained. Probably at that time the still in Rubona was up and running.
- **Codes et Lois du Rwanda**. Vol. IV page 1931. Medicinal plants, Insecticides and Aromatic Plants. The law no. 53/389 relating to export of essential oils of *Geranium rosat*, Eucalyptus, Vetiver, Lemongrass and Mentha, which need a special export license. The law no. 53/233 fixes the tax on export of these essential oils 750 Frws (U$ 1.63). The Law has been in existence since August 1st, 1952. Law no. 53/390 deals with the export of Digitale, Belladone, camomille flowers etc and again an export license is required, but unlike essential oils there is no tax on exports.

2. RWANDA SPECIFIC GENERAL INFORMATION:

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- **ADAR/Chemonics/CIRAD-FLHOR Rapport. CONFIDENTIAL.** Analyse des Opportunités de Développement du Secteur de la Transformation des Fruits et Légumes au Rwanda. F. Vaillant. 2002. Looks at the operations of existing food processors and finds some prospects for local and regional market expansion but strong competition on the small local juice concentrate market. Also examined is the SORWATOM 500 tonne p.a. capacity tomato concentrate plant which is basically intact but would need an estimated US$430,000 to be rehabilitated, and this, given a strong local demand, is recommended. Dried fruits, vacuum packed cooking bananas and physalis conserves identified as having strong potential for exports.

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- **G. Troupin** (Editor) (1987) . Flore du Rwanda. Spermatophytes. Vol.IV, 651 p.
- **Gapusi, R.J. and Mugging, C.** (1997). Espèces Rares Ou En Extension Dans La Flore Du Rwandaise. Revue Bibliographique
- **IRST**. Flore du Rwanda Vols 1-4. Lists all the plants found in Rwanda including exotics, and specimens of all of these were collected and housed at the Herbarium in Butare. Gives the Kinyarwanda and Latin names of the plant, its description as well as its distribution its distribution in Rwanda. In order to exploit our flora in a sustainable way, it will be very important to refer to Gapusi and Mugunga's revue on 'Espèces Rares Ou En Extension Dans La Flore Du Rwandaise. Revue Bibliographique'.
- **Revue Médicale Rwandaise #63, 1999.** B I Mpfizi and B Makanga. Overview on Schistosomiasis control with Endod. Phytolacca dodecandra (Endod-Ethopian name, soapberry plant) Used to be used for washing in Rwanda- not much used now? Downstream- bilharzia (Schistosomiasis) vector snails are killed. Disease is prevalent in wetlands which are found in most areas of Rwanda in valleys bordered by hills.
- **IITA.** International Institute of Tropical Agriculture. Medicinal Plants in Uganda. KertlandWright P. 2002. PO Box 23825 Kampala. gwg@africaonline.co.ug Lists main medicinal plants and details of contacts in Uganda.
- **Raynal, J., Troupin, G. and Sita, P**. (1981). Flore et Médecine Traditionnelle . Mission d' etude 1978 au Rwanda. I- Observation Floristique. Published by Agence de Coopération Culturelle et Technique. (336 pages).
- **Raynal, J., Troupin, G. and Sita, P**. (1985). Médecine Traditionnelle et Pharmacopée: Contribution aux Etudes Floristiques au Rwanda. Published by Agence de Coopération Culturelle et Technique.(286 pages). Publication similar to the above with same authors.
- **Desouter, S**. (1991). Pharmacopée Humaine et Vétérinaire du Rwanda (252 pages)
- **CITES** (2001). Checklist of CITES Species (335 pages)
- **Bordas** (1994). Plantes Aromatiques et Médicinales . 700 species. (304 pages).

- **Troupin, G**. (1982). Flores des Plantes Ligneuses du Rwanda. (747 pages)
- **IRST** (2000). Recherche sur les Plantes Médicinales et leur Utilisation dans le Traitement des Maladies Infectieuses en Afrique de l'Est. Compte –Rendu du séminaire tenu au centre pharmacopée de l' IRST du 24-26 Octobre 2000. (76 pages). Seminar proceedings.
- **IRST** (1999). Séminaire sur les Plantes Médicinales et la Pharmacopée Traditionnelle. Compte-rendu des Travaux. Butare, du 26-28 /10/1999.

Non Wood Forest Products (NWFP)

- **FAO/EU** Les Données Statistiques Sur Les Produits Forestiers Non Ligneux Au Rwanda. (NWFP's). Mihigo A. Dec 99. www.fao.org/DOCREP/003/X6735F/X6735F00.HTM
  Extensive list of forest plants used in Rwandan traditional medicine, for veterinary purposes, decorative plants for possible floriculture use, culinary and handicraft purposes- as well as mammalian populations. Very little NWFP's are currently exported. Wild mushroom export is mentioned as a possibility.

4. OTHER MATERIAL- REGIONAL

- **Ugandan Ministry of Finance**. 1993. Opportunitities for Non-Traditional Agricultural Exports- Cereals, Beans and Oilseeds- from Uganda. IST Washington and High Value Horticulture, UK. Concludes that, given high transport costs, these lower value crops are generally viable export commodities only in the region, and to supply food deficits in countries such as Kenya and Rwanda. Pyrethrum Board of Kenya. Bulletins on use and formulations of Pyrethrum on Mosquitoes, Household, Livestock and Crops Pests.

5. GENERAL

- **CBI**. Netherlands. Natural Ingredients for Pharmaceuticals. 2000.
- **CBI**. Netherlands. Natural Ingredients for Cosmetics. 2001
- **Spices**. Vols 1 & 2. J.W. Purseglove et al. Comprehensive information on most major spice crops.
- **Tropical Monocotyledons/Dicotyledons**. J.W. Purseglove. Extensive information on tropical crops.
- **The Essential Oils**. Guenther. Publishers Robert E.Krieger 1950. 6 Volume definitive work on world production, chemistry etc. Dated but very comprehensive- an indispensable reference work.
- **Natural Resources Institute (NRI) UK**. Eucalyptus Oils- A Review of Production and Markets. 1992. ISBN 0-85954-3080-0. A comprehensive survey – required reading for those involved in any new eucalyptus project.

- Field Distillation of Herbaceous Oils. **T Denny. A detailed technical analysis of distillation science, with useful practical guides to still and condenser design.**
- Clean Spices Handbook**. American Spice Trade Association.** http://www.astaspice.org/

6. WEBSITE LIST

- **Rwanda Government** investors/exporters incentives .www.minecofin.gov.rw/investors/investment_incentives.htm
- **Access** to the EU markets General information is on www.cbi.nl/accessguide and **tariffs** on www.douane.nl and for the
- **USA tariff and trade** statistics information is on http://dataweb.usitc.gov
- **Pyrethrum** products and use. www.pyganic.com
- **Greentrade :** www.greentrade.net Prices and market place for organic produce.
- **The Public Ledger**. www.public-ledger.com Market information on most commodities. Paid subscription service.
- **MarketAG** www.marketag.com/ma Market surveys and price information
- **CGIAR**. Consultative Group on International Agricultural Research. Links to research sites. Market information.
- **ASNAPP.** www.asnapp.org. Extensive library on natural products- medicinal and herb teas. www.asnapp.org/links_pages/links_market_research.htm
- **RAISE.** www.raise.org . Market information on Natural Products, Organic Crops etc.
- **ITDG.** www.itdg.org Intermediate Technology Design Group. Agro Processing Equipment.
- **Fintrac Inc**. www.fintrac.com Market information- perishables. Free.
- **FAO**. www.fao.org Trade statistics
- **Organic Trade Services** www.organicts.com/ Organic news and statistics.

ANNEX II : EU Reg 2092/91

A. FERTILIZERS AND SOIL - CONDITIONERS

General conditions for all the products:

- use in accordance with provisions of the Regulation
- use only in accordance with the provisions of fertilizer legislation applicable within each Member State.

Products authorized exceptionally for use in soil conditioning and fertilization, in accordance with the dispositions of Annex I (2)

Name	**Description; compositional requirements; conditions for use.**
Compound products or products containing only materials listed hereunder:	
Farmyard manure	- Product comprising a mixture of animal excrements and vegetable matter (animal bedding) Need recognized by the inspection body or inspection authority - Indication of animal species - Coming from extensive husbandry and only in the sense of Article 6 (4) of Council Regulation (EEC) No 2328/91 (1), as last amended by Regulation (EC) No 3669/93(2)
Dried farmyard manure and dehydrated poultry manure	- Need recognized by the inspection body or inspection authority - Indication of animal species - Coming from extensive husbandry and only in the sense of Article 6 (4) of Regulation (EEC) No 2328/91
Composted animal excrements, including poultry manure and composted farmyard manure included	- Need recognized by the inspection body or inspection authority - Indication of the animal species - Factory farming origin forbidden
Liquid animal excrements (slurry, urine, etc.)	- Use after controlled fermentation and/or appropriate dilution - Need recognized by the inspection body or inspection authority - Indication of animal species - Factory farming origin forbidden
Composted household waste	- Compost of source separated household waste - Only vegetable and animal waste - Produced in a closed and monitored collection system, accepted by the Member State - Maximum concentrations in mg/kg of dry matter: Cadmium: 0.7; Copper: 70; Nickel: 25; Lead: 45;

	Zinc: 200; Mercury: 0.4; Chromium (total):70; Chromium (VI) :0 (*) (*) limit of determination - Only during a period expiring on 31 March 2002 - Need recognized by the inspection body or inspection authority.
Peat	- Use limited to horticulture (market gardening, floriculture, arboriculture, nursery)
Mushroom culture wastes	
Composted mixture of vegetable	- The initial composition of the substrate must be limited to products of the present list
Products or by-products of animal origin as below: - blood meal - hoof meal - horn meal - bone meal or degelatinized bone meal - animal charchoal - fish meal - meat meal - feather, hair and "chiquette" meal - wool - fur - hair - dairy products	- Need recognized by the inspection body or inspection authority - Need recognized by the inspection body or inspection authority maximum concentration in mg/kg of dry matter of Chromium (VI):0 (*) (*) limit of determination
Products and by-products of plant origin for fertilizers (for instance: oilseed cake meal, cocoa husks, malt culms, etc.) Seaweeds and seaweed products	As far as directly obtained by: - physical processes including dehydration, freezing and grinding; - extraction with water or aqueous acid and/or alkaline solution; - fermentation; need recognized by the inspection body or inspection authority
Sawdust and wood chips	- Wood not chemically treated after felling
Composted bark	- Wood not chemically treated after felling
Wood ash	- From wood not chemically treated after felling - Product as specified by Council Directive 76/116/EEC (3), as last amended by Directive 89/284/EEC (4) - Cadmium content less than or equal to 90 mg/kg of P205
Aluminium calcium phosphate	- Product as specified by Directive 76/116/EEC, as last amended by Directive 89/248/EEC; - Cadmium content less than or equal to 90 mg/kg of P205
Basic slag	- Use limited to basic soils (pH > 7,5)
Crude potassium salt (for instance: kainit, sylvinite, etc.)	- Need recognized by the inspection body or inspection authority - Need recognized by the inspection body or inspection authority
Potassium sulphate containing magnesium salt	- Need recognized by the inspection body or inspection authority - Derived from crude potassium salt
Stillage and stillage extract	- Ammonium stillage excluded
Calcium carbonate of natural origin (for instance: chalk, marl, ground limestone, Breton ameliorant,	- Only of natural origin

(maërl), phosphate chalk)	
Magnesium and calcium carbonate of natural origin (for instance: magnesium chalk, ground magnesium limestone, etc.)	- Need recognized by the inspection body or inspection authority - Foliar treatment of apple trees, after identification of deficit of calcium
Magnesium sulphate (for instance: kieserite)	- Need recognized by the inspection body or inspection authority
Calcium chloride solution	- Product as specified by Directive 76/116/EEC, as amended by Directive 89/284/EEC
Calcium sulphate (gypsum)	- Only of natural origin - Need recognized by the inspection body or inspection authority
	- Only during a period expiring on 31 March 2002
Elemental sulphur	- Product as specified by Directive 76/116/EEC, as amended by Directive 89/284/EEC - Need recognized by the inspection body or inspection authority - Trace elements included in Directive 89/530/EEC(5)
Trace elements	- Need recognized by the inspection body or inspection authority
Sodium chloride	- Only mined salt
Stone meal	- Need recognized by the inspection body or inspection authority

B. PRODUCTS FOR PLANT PROTECTION

General conditions applicable for all the products composed or containing the following active substances:

- use in accordance with provisions of annex I,
- only in accordance with the specific provisions of the plant protection product legislation applicable within the Member State where the product is used (where relevant(*)).

I. Substances of crop or animal origin

Name	**Description; compositional requirements; conditions for use**
Azadirachtin extracted from *Azadirachta indica.* (Neem tree)	Insecticide; only to be used on mother plants for the production of seeds and on parent plants for the production of other vegetative reproductive material, and on ornamental crops.
(*) Bees wax	Pruning agent
Gelatine	Insecticide
(*) Hydrolysed proteins	Attractant; only in authorized applications in combination with other appropriate products of this Annex II, part B .

Lecithin	Fungicide
Extract (aqueous solution) from *Nicotiana tabacum*	Insecticide; - only against aphids in subtropical fruit trees (e.g. oranges, lemons) and tropical crops (e.g. bananas); use only at the start of the vegetation period; - need recognized by the inspection body or inspection authority; only during a period expiring 31 March 2002.
Plant oils (e.g. mint oil, pine oil, caraway oil).	Insecticide, acaricide, fungicide and sprout inhibitor.
Pyrethrins extracted from *Chrysanthemum cinerariaefolium*	Insecticide
Quassia extracted from *Quassia amara*	Insecticide, repellent
Rotenone extracted from *Derris spp. and Lonchocarpus spp. and Terphrosia spp.*	Insecticide; need recognized by the inspection body or inspection authority.

(*) In certain Member States the products marked with (*) are not considered as plant protection products and are not subject to the provisions of the plant protection products legislation.

II. Micro organisms used for biological pest control

Name	**Description; compositional requirements; conditions for use**
Microorganisms (bacteria , viruses and fungi) e.g. *Bacillus thuringensis, Granulosis virus,* etc.	Only products, not genetically modified in the meaning of Directive 90/220/EEC (1).

(1) O.J. No L 117, 8.5. 1990, p 15.

III. Substances to be used only in traps and/or dispensers

General conditions:

- the traps and/or dispensers must prevent the penetration of the substances in the environment and prevent contact of the substances with the crops under cultivation.
- the traps must be collected after use and disposed of safely

Name	**Description; compositional requirements; conditions for use**
(*) Diammonium phosphate	Attractant; only in traps
Metaldehyde	Molluscicide; - only in traps containing a repellent to higher animal species; - only during a period expiring 31 March 2002.
Pheromones	Insecticide, attractant; in traps and dispensers.
Pyrethroids (only deltamethrin or lambdacyhalothrin)	Insecticide; - only in traps with specific attractants; - only against *Batrocera oleae and Ceratitis capitata wied;* - need recognized by the inspection body or inspection authority; - only during a period expiring on 31 March 2002.

(*) In certain Member States the products marked with (*) are not considered as plant protection products and are not subject to the provisions of the plant protection products legislation.

IV. <u>Other substances from traditional use in organic farming</u>

Name	Description; compositional requirements; conditions for use
Copper in the form of copper hydroxide, copper oxychloride, (tribasic) copper sulphate, cuprous oxide	Fungicide; - Until 31 December 2005, up to 8 kg copper per ha per annnum. (NB Other conditions subsequently updated) - Need recognized by the inspection body or inspection authority.
(*) Ethylene	Degreening bananas
Fatty acid potassium salt (soft soap)	Insecticide
(*) Potassium allum (Kalinite)	Prevention of ripening of bananas
Lime sulphur (Calcium polysulphide)	Fungicide, insecticide, acaricide; only for winter treatments in fruit trees, olive trees and vines.
Paraffin oil	Insecticide, acaricide
Mineral oils	Insecticide, fungicide; - only in fruit trees, vines, olive trees and tropical crops (e.g. bananas); - only during a period expiring on 31 March 2002; - need recognized by the inspection body or inspection authority.
Potassium permanganate	Fungicide, bactericide; - only in fruit trees, olive trees and vines.
(*) Quartz sand	Repellent
Sulphur	Fungicide, acaricide,repellent

(*) In certain Member States the products marked with (*) are not considered as plant protection products and are not subject to the provisions of the plant protection products legislation.

ANNEX III : BUYERS LIST

1. Essential oils

- **CL Teubes Pty Ltd**. Traders and Processors. 75 Wakis Av Strydom Pk Johannesburg. South Africa Potential buyer of non organic and some organic oils..
- **Fuerst Day Lawson** 111 Minories, London SW1. Large scale traders in conventional oils.
- **EarthOils Ltd**, 141 Beacon St Lichfield StaffordshireWS13 7BG. Organic oils trader.
- **R C Treatt & Co Ltd**, Northern Way, Bury St Edmunds, Suffolk. Traders and processors in conventional oils.

2. Herbs/spices-capsicums non-organic

- Paprico Zimbabwe 32 Anthony Av Msasa, Harare, Zimbabwe.
- Paprika Zimbabwe, Tel + 263 4 487876/8 FAX 487879 Oleoresin Extractors.

3. Herbs/Spices -Organic

- Organic Herb Trading Co**.** www.organicherbtrading.com.
- Euroherb Bio BV. euroherb@euroherb.nl .

4. Fixed oils- organic

- EarthOils Ltd, 141 Beacon St Lichfield StaffordshireWS13 7BG.

ANNEX IV : CONTACTS DATABASE

Note: Address details where not given can be obtained from the **ADAR** contact directory or from the consultants.

1. NGOs- International

Action Aid, Handicap International, ADRA (Adventist Development and Relief Agency), Africa Evangelistic Enterprise(**AEE**), **AFRICARE**, Germano Agro Action (**G.A.A**), Aide et Action, American Refugee Committee (ARC), Armée du Salut, Association de Coopération et de Recherche pour le Développement (**ACORD**), Association des Volontaires pour le Service International (**AVSI**), Associazione di Cooperazione Allo Sviluppo (**ACS**), Associazione Solidarita Perle Sviluppo (**ASS**), Australian Help Program (**AHP**), Avocats Sans Frontieres (**AS**F), Care International, Catholic Relief Services (**CRS**), Centre Canadien d' Etudes et de Coopération Internationale (**CECI**), Christian Aid, Christian Outreach, Compassion International, Concern Worldwide, Coopération Technique Allemende (**GTZ**), **OXFAM GB**, **OXFAM QUEBEC**, World Relief International, World Vision International.

2. NGOs- Local

ADEHAMU (Action de Developpement des Hautes Terres de Mukura), APIDERBU (Action pour le Développement Rural dans la Zone de Busoro)), **ADENYA** (Action de Développement de Nyabimata)**, ATEDEC** (Action Technique pour un Dévelopment Communautaire), AFCF (Association des Femmes Chefs de Familles), **AFE**R (Association des Femmes Entrepreneurs au Rwanda), **AVODI** (Association des Volontaires pour le Développement Intégré), ADAP (Association pour le Développement Agro Pastoral), **Solace Ministries** and many others some being members of CCOIAB, un umbrella organization for local NGO's working in rural areas.

3. CONTACTS MET

- **Rwandan Investment Promotion Agency** (RIPA). Director General Bonaventure Niyibizi. + 250 585223. ndolipax77@yahoo.fr
- **D.N.International,** Nathan Loyo + 250 852 45 45 NLndungu2001@yahoo.com. Planning Avocado Oil production project. Possible organic sourcing of material.

- **Shema Fruits s.a.r.l.**, Catherine Mukamazimpaka , Shema Fruits (Food Processor, Jams/Fruit Pulp possible expansion to tomato based products), Cell 0850 3640, BP 395 Butare, Tel 530 424 Fax 530738.
- **Ameki Colour**. Jacques Rusirare, BP 1162, Kigali, Tel 512173, Fax 512174, Mobile 0803 02474. Paint Mfg- possible growers and processor of sunflower oil but not castor oil.
- **SOPYRWA** Pyrethrum Extraction Factory.
  PO Box 79, Ruhengeri.
  Paul Muvunyi, Managing Director.
  Joseph Twagirayezu, Consultant
  Dominique Rugumire, Asset Manager & Inspector
  Joseph Mutarambirwa, Chef de Fabrication
  Hermogène Habumugisha, Agronomist.
- **Rutamu**, Innocent. Tel 519132. BP 6383 Kigali. innorut@rwanda1.com . Possible promoter of project to grow paprika and chillies.
- **Bilindabago**, Alexis. Rt Rev, Bishop of Gahini Diocese. BP 22, Kigali. Tel 64722. Possible co-ordinator of producers of new crops. Potential nursery for plant propagation and trials on sustainable farming using organic methods.
- **IRST**. Pharmacology Centre. bp 227, Butare. tel 530875. stills and essential oil planting material.
- **ISAR.** Rwanda Agricultural Research Institute
- **Dr E Mugunga,** Director General, PO Box 138, Butare Tel 530145. ISAR own a still at Ruhande station.
- **Gapusi** Rwahaniza, Jean. Chef de Station, ISAR Butare. Plant nursery for agroforestry and medicinal plants. BP 617, Butare. Tel 530308. gapusirj@mail.rw
- **ICRAF. Innternational Centre for Research in Agroforestry** (supported by Consultative Group on International Agriculture (CGIAR)). Dr Christopher Zaongo, Soil Scientist, BP 4254 Kigali. Tel 530642. zaongocgl@hotmail.com
- **SAKIRWA**. Patrice Hainault, D.G. BP 441 Kigali. Tel 586951 Fax 586078 08302495. sakirwa@hotmail.com
- **Sulfo Rwanda Industries S.A**. BP 90 Kigali. www.sulfo.com sulforwa@rwanda1.com. H. .Dharmarajan, D.G. Atma Prakesh, P.K. Dir. Marketing.
- **PEARL** Program, BP 52, Butare. Tim Schilling. Tel 530050. schillin@rwanda1.com. Coffee washing station and possible plant nursery/trial area in conjunction with University.

ANNEX V : ANALYSIS OF PAST AND CURRENT AGRICULTURAL EXTENSION SYSTEMS

Establishment of new crops and revival of previously farmed plant will require liaison with all extension resources available to make success more likely. An analysis of Rwandan extension systems is included as background.

A study by Harrison & Baxter (1984) reported that most agricultural projects had not been well analysed before implementation, were mismanaged and very few left a tangible impact. Other extension problems included the standard litany of poor organisation, dilution of effort, poor mobility, ineffective demonstration, poor training, unspecialised staff, poor research links and duplication of services. This led the government to seek a new approach which was suggested by the World Bank and in 1986 a pilot project-PAG (Project Agricole de Gitarama) was launched with the Training and Visit (T&V) extension system. The key elements of the T&V system are listed as a unified extension service: one single line of command, extension only, systematic T&V, concentrated effort, best use of resources, recommendations tailored to farmer capability, strong research linkages, links with agricultural suppliers, continuous improvement through monitoring and evaluation, regular and continuous training of all staff, and focused efforts aimed at increasing agricultural production using specific technology transfer.

In 1991 while an evaluation of PAG was needed to show the strengths and weaknesses of the T&V system in Rwandan context; the Ministry of Agriculture (MOA), with support from the World Bank, adopted the T&V system as the national extension system funded by the WB through the 'Projet Services Agricoles (PSA)' with a very highly centralised structure.

Before 1994, the T & V was the national extension service with a good ratio of extension workers/farmers. With the tragic events of 1994 war & genocide, the system could no longer function. In January 1998, the MOA took a decision to set up a new extension system based on principles of decentralisation, participation and partnership and using Research/Development and participatory planning approaches.

The New National Extension System

Political context

The new national extension system is based on four key elements of Rwandan policy in the agricultural sector:

i) Withdrawal of the State

ii) Privatisation

iii) Participation

iv) Effectiveness

Objectives of the national extension service

i) To facilitate the use of better production techniques

ii) To increase the volume of production for food security and the increase of exports

iii) To increase farmer income for better rural living conditions and enhance farmer buying capacities

iv) To protect the environment by protecting natural reserves and to fight against pollution

v) Solving problems that limit input supply and reduce the value of production, and

a) Solving the problems that limit input supply by, for instance

♦Facilitating and diversifying input supply with the programme of seed production among others and implementing strategies like ordering inputs in group.

♦Improving farming equipments and infrastructures, programme elaboration and community managed infrastructures.

♦Allowing easy access to credits using solidarity deposits and promoting savings.

b) Solving problems that reduce the value of the production by, for instance:

♦Improving the storage of products with the building up of appropriate storage facilities which are well managed.

♦ Allowing local processing of the production that needs availability of expertise in appropriate post-harvest technologies.

♦Merchandising the production which requires information on existing markets and market prices to allow sale organization.

c)Ameliorating life and working conditions of people in countryside:

♦Training, informing and sensitising people to increase their education level which makes their social life richer and better.

♦Reducing the hardship of work by using more efficient tools.

Beneficiaries of extension services

There are three categories of beneficiaries of extension services:

♦Individual producers, isolated but invited to organise themselves into associations.

♦Autonomous farmer's associations able to manage themselves.

♦ Entrepreneurs in agriculture or agro-business people.

The strategy of the national extension service

♦ Research & Development using a negotiated planning system between farmers and government to carry out

Rural Appraisal

Identification of solutions

Validation of solutions

♦Working with farmers' associations and promoting the setting up of real professional farmers' organizations and a diffusion system which help farmers to appreciate suggested solutions (demonstrations, visit, etc.)

Who takes part in extension?

♦National extension service with limited staff but well educated to insure methodological conception, general organisation, management, training and; monitoring and evaluation;

♦Various partners (researchers, technicians of the MOA, NGOs, private entrepreneurs, farmer's associations) involved according to their competence and capabilities for precise and timely interventions.

♦ Farmers' associations are a privileged group of agricultural extension partners. Their mission is to form well organised structures which represent the rural community. They are invited to take part in all the process of extension i.e. rural appraisal, planning, implementation and self-evaluation.

Financing Extension Services

There are two types of costs:

i) Structural costs to allow regular and permanent functioning of the National Extension Service. Such costs should be allocated from the ordinary functioning costs of the MOA.

Operational costs financed today through programmes with the participation of certain operators such as NGOs, private people, associations of professionals etc.. This, in the future should evolve into endogenous centres of development where satellite farmers' associations would get advisory services from a local NGO responsible for agricultural extension in the area.

ANNEX VI : TERMS OF REFERENCE

ASNAPP Study on Natural Plants in Rwanda
Market Assessment- Scope of Work.

I. Objective

The objective of the study is to assess the potential for development of Rwandan high-value natural products and provide recommendations, leveraging the findings of the initial product assessment. The market study that has a domestic and an external focus, is twofold:

- Consolidate existing information and collect additional field data to understand the current market for natural products in Rwanda:
  - Which natural products are currently being produced/ used in Rwanda?
  - Who are the key players? Growers, gatherers, processors, wholesalers, retailers, exporters, importers, providers of financial services, consumers, local or regional networks (local NGOs, associations and cooperatives) and sponsors.
  - What are the current processes and practices? Growing and maintenance, collecting, drying, storage, processing, quality control, packaging, transportation, marketing and financing of farming activities.
  - What is the state of current infrastructure? Resources, capacity, use of technology and standards in place.
  - What are the distribution and consumption patterns? Distribution channels, outlets, prices, volumes, consumer segments and product conditioning.
  - What are Rwanda's current assets and limitations? Natural conditions, skills and knowledge, availability of financial resources, market policies, legal framework (Property rights, Plant protection), etc.
  - Is there any institutional support available from government agencies?

- Analyse the possibility to supply high-quality natural products to local, regional and export markets. ASNAPP research work in other countries has included the following types of products: herbal teas, spices and culinary herbs, traditional medicine, non-timber forest products and essential oils.
  - What are the market size, key trends and characteristics?
  - Who are the potential customers and customer segments?
  - What are the essential attributes required for the products/ substitution products?

- Who are the major competitors, and major players?
- What are the major barriers to entry?

What is Rwanda's relative position?

II. Specific Tasks to Be Performed during the Consultancy

In order to meet the objectives mentioned above, the tasks to be performed during the consultancy are as follows:

- Gather secondary research information on Rwanda's market for natural products. Results of the product assessment in Rwanda will be leveraged;
- Gather secondary research information on international markets for Rwandan natural products. The ASNAPP network will be leveraged when possible. Phone interviews with key players in regional or international markets may also be necessary;
- Gather information on Rwanda's market for natural products from the field: visit outlets for natural products (local markets, pharmacies), identify major players and products, and conduct interviews with key players (farmers, processors, consumers, etc.);
- Assess current production and processing capacities based on field visits;
- Compile and analyze data;
- Make recommendations on which high-value natural product(s) Rwanda could consider producing and marketing;
- Characteristics of supply and demand for natural products in Rwanda (indigenous or introduced);
- Opportunities within regional or international markets for high-value natural products grown in Rwanda (indigenous or introduced);
- SWOT analysis (Strength, Weaknesses, Opportunities and Threat) for each natural product cluster in the scope of the assessment;
- Recommendations regarding the next steps to develop a market for Rwanda high-value natural products.

The study is not viewed as a conclusive review but as providing initial data and conclusions that will be updated regularly if at the outcome of the assessment, the decision is made to pursue with the project further, working on the actual implementation of a pilot project in Rwanda. This later phase would include selecting a natural plant cluster and a farming community, defining the business model to adopt so as to support the exploitation of selected plants and building a step-by-step plan to build capacity for natural plants management and commercialization.

ANNEX VII: SAMPLE SPECIFICATION- ORGANIC HERBS/SPICES-MICROBIOLOGICAL

Lunn-Links

Greenbrier, ~ Victoria Rd, ~ Brixham, Devon, ~ TQ5 9AR.
Phone 01803 853579 ~ Fax 01803 883892 ~ Email: llorganic@aol.com
Web Site at: www.Kitchen-Garden.co.uk
Organic & Fairtraded Food Suppliers

SUPPLEMENT FOR ORGANIC HERBS & SPICES BATCH NO. PREFIX DG

LIMITING VALUES FOR HERBS AND SPICES

Microbiology	Bundesgesundheitsblatt 31 Nr. 3	Guide value (CFU/g)	Maximum value (CFU/g)
	Aerobic platecount	1.0×10^6	1.0×10^7
	Anaerobic platecount	------	------
	Escherichia coli	1.0×10^4	------
	Staphylococcus aureus	1.0×10^2	1.0×10^3
	Bacillus cereus	1.0×10^4	1.0×10^5
	Clostridien	1.0×10^4	1.0×10^5
	Yeasts and Fungi	1.0×10^5	1.0×10^6
	Salmonella/25g	negative	negative
Aflatoxin	"Aflat, Verordn. (Annex 2 paragraphs 1 & 2) Date from 06/11/90" (German)	Detection limit (µg/kg)	Maximum value (µg/kg)
	B_1	0.1	2.0
	B_2	0.1	
	G_1	0.15	
	G_2	0.1	
	Σ B_1, B_2, G_1, G_2		4.0
Heavy metals	"BGVV; Richtwerte für Schadstoffe in Lebensmitteln, BGB 5-96" (German)		*Maximum value (mg/kg)
	Cd		0.10
	Pb		2.00
	Hg		0.05

* Maximum values in mg/kg based on the fresh weight or in the offered form. In dried products based on the rehydrated product.

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